FEBRUARY 29, 1936

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ELECTRICAL WORLD

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Central panel of seven forming background of General Electric Company exhibit at the opening of New York's new Museum of Science and Industry at Rockefeller Center

Year Ends on Rising Trend + + + Load Building in the Northwest + + + Power Telemetered on Pennsylvania Line + + + Selling Power to Industry + + + Sheath Corrosion at Bond Straps Prevented + + + New Device Speeds Rate Analysis + + + Rectifiers Reduce Control to Three Wires + + + Costs and Construction of Farm Lines

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ELECTRICAL WORLD

MANAGEMENT • ENGINEERING • OPERATION • UTILIZATION

PUBLISHED EVERY SATURDAY

FEBRUARY 29, 1936

While the Courts Decide—

This is the starting period for many legal decisions involving utilities. Second thought on the T.V.A. decision places it in a position of minor importance. The wide principles underlying the project are yet to be passed upon and uncertainty must remain until actions take the place of promises and thus give reasons for a complete Supreme Court opinion.

Of equal importance is the decision of a federal court dealing with the South Carolina power project. No one doubts the right of the state to undertake the development, but has the federal government the constitutional right to encourage a state to do such a thing by loaning it money at low interest? An interesting question will now be appealed to the Supreme Court for adjudication.

Up over the horizon come the legal battles over the public utility law. The recent decision in the American States Public Service case is interpreted to mean that if each subsidiary does an intrastate business, no matter if all are owned by a holding company, registration is not required. This opens a wide gate for escape from destructive regulation if this ruling is sustained.

But why go on? On every front legal battles are at hand and others will crop up. The fight of the utilities is in the hands of the lawyers to defeat existing destructive legislation. This involves time and great expense to themselves, to the ratepayers and to the security owners. The unwarranted attack on an essential and deserving industry is being met with the only available weapons—lawyers and the courts. Congress passed the laws, but the courts will decide their validity.

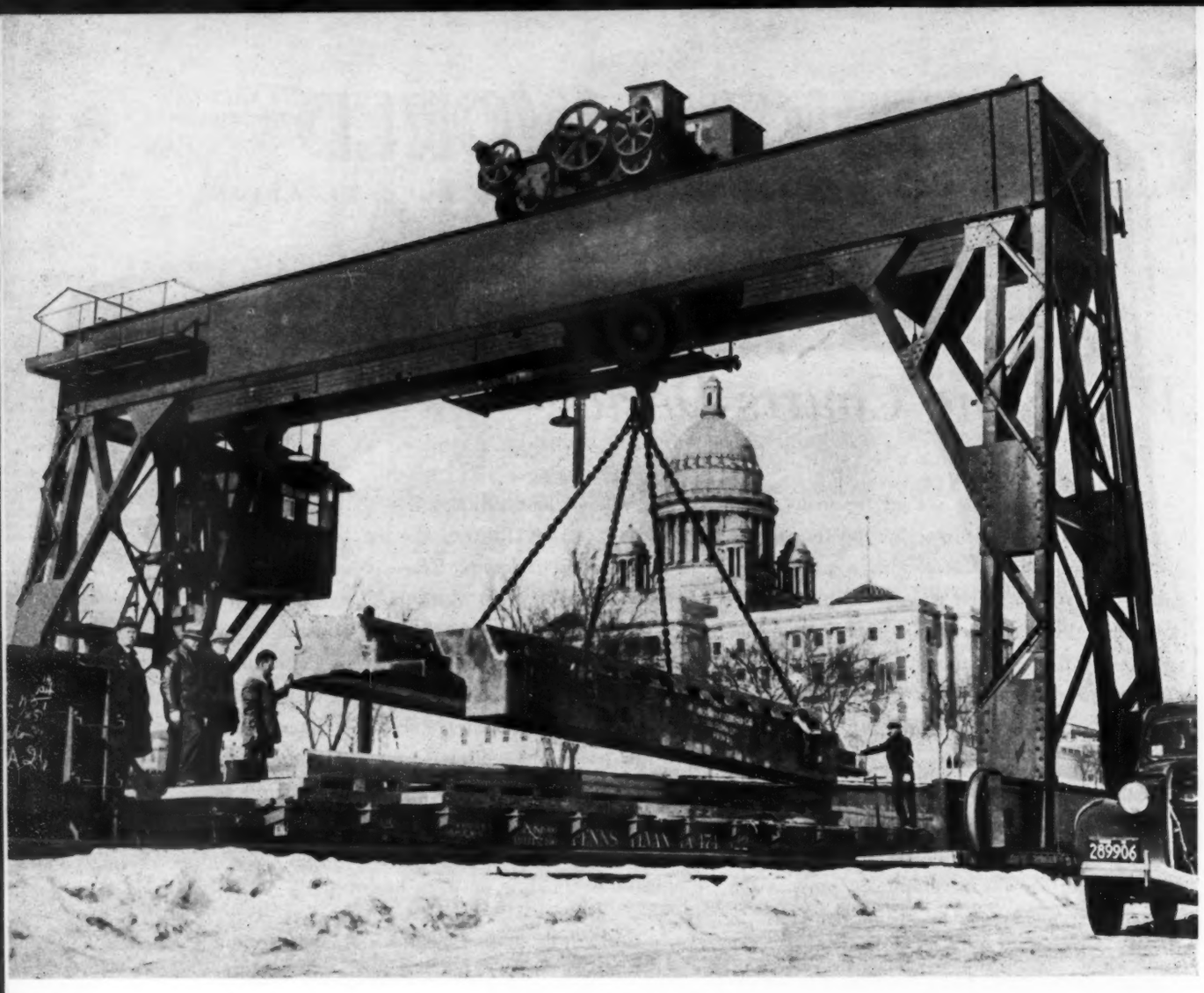
Under the conditions it is well to be patient and to let the lawyers do the legal fighting. That is their function. *The men and women of the industry, in the meantime, have their own jobs to do.* They are building business, improving service, continuing to put their house in order and endeavoring to conduct their affairs so that such an unwarranted attack cannot recur through similar Congressional legislation. There is much to be done, but all the work points in one direction—more prosperity and better public relations. While the lawyers fight, the industry is buckling down to business.

And it is getting results. A visit around the country brings an impression of a better spirit, an improved morale and an intensification of activities that are encouraging and stimulating. Each utility is no longer discouraged or cowed. It has resolved to work its way out of its troubles. Local results are already evident. And we count more on this program than we do on legal victories for final success.

But, on an organized national basis, the industry also should act. It should recommend amendments to regulatory laws that will make them fair and workable, however severe. It should tell the true facts about the business of power supply. It should use joint efforts to increase business. It should produce and publicize its policies in giving service and decreasing rates and state its code of principles for the conduct of the business. The public is the final arbiter, and the public must understand and have confidence to be fair.

Silverthorne Morrow

Editor



TRANS-SHIPPED MATERIAL HANDLED QUICKLY

Rhode Island state capital building framed by the bridge of a 40-ton traveling crane as it gently lowers a huge casting into position on a flat car. Handling of heavy freight in trans-shipping material in modern railway yards has been greatly expedited in recent years by electric cranes similar to this one. Ease with which huge masses are moved about and positioned is directly traceable to rapid strides that have been made in the design of electrical control equipment. Widespread use of electrical material-handling equipment reflects an awakened consciousness of the part electricity plays in industry and commerce.

Sheath Corrosion at Bond Straps Prevented

Galvanic Action Stopped by New Arrangement of Strap—Use of Superior Fireproofing and Insulating Coating on the Lead Sheath

Presence of alkaline moisture in cement fireproofing forms a short-circuited cell where copper bond straps are soldered to the lead cable sheath and the lead may be destroyed. Keeping the bond strap out of contact with the fireproofing and providing an insulating coating for the lead of primary cables are preventive measures which have been found effective in laboratory tests and in practice. Also, the use of certain branded types of fireproofing instead of Portland cement has the advantage of an inherently slower rate of corrosion.

By EDGAR F. WOLF

Consolidated Gas, Electric Light & Power Company, Baltimore

FAILURES had occurred on two 4-kv. cables in manholes within about an inch of the point where the tinned copper bonding straps were soldered to the lead cable sheath. In both cases ⅜-in. wide x 0.050-in. thick tinned copper bonding straps had been taped to the lead with friction tape and then soldered to the lead. In this way the copper ran along the lead for several inches. The one cable was fireproofed by wrapping with sisal rope and applying a cement coating on the outside. The other cable was fireproofed with an approximately 1:3 cement sand mixture applied with cheesecloth.

In both cases the lead was heavily corroded for several inches from the point where the bonding strap was soldered to the sheath. The metallic lead was converted into a hard red crystalline material, identified as the red modification of lead monoxide.

Measurements made with a potentiometer between the various metals concerned in water leached from three-day-old concrete confirmed the suspicion that galvanic action was to be blamed.

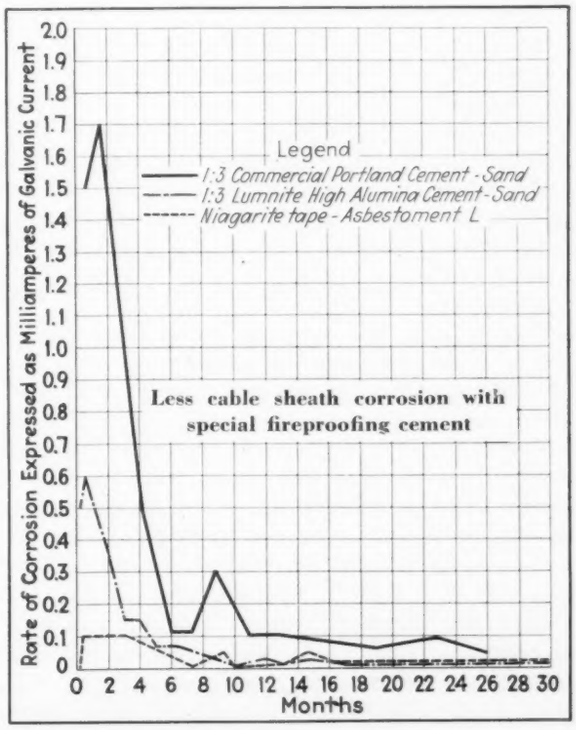
Galvanic potential measurements

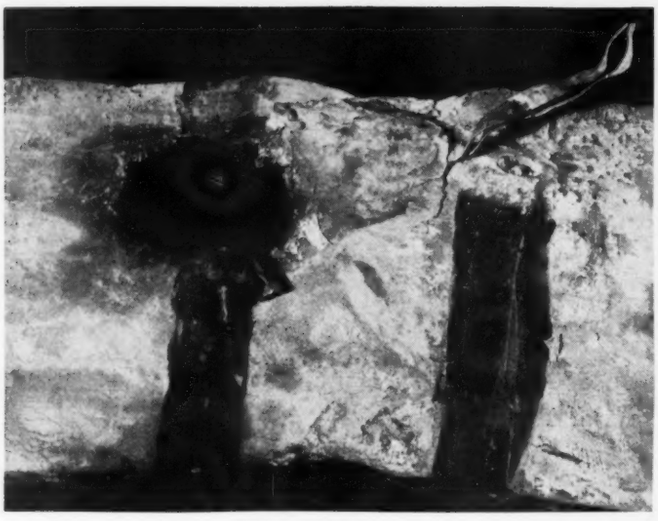
Metal Externally Positive	Metal Externally Negative (Anodic)	Potential
"Tinned" copper	Lead	0.524 volts
Copper	Lead	0.491 volts
40-60 solder	Lead	0.006 volts

To reproduce the conditions which were believed to be the cause of the corrosion specimens with copper straps and specimens without copper straps were incased in a concrete composed of one part of Portland cement and three parts of sand. These specimens were kept moist for three months. At the end of this time examination showed that in all cases where the bonding strap ran for several inches near the lead the lead was heavily corroded. The lead was converted into a hard brilliant red crystalline corrosion product which was exactly similar in appearance to the corrosion on the cables which failed in service.

Since these original failures several additional service failures have occurred and extensive inspections of cables near the bonding straps have been conducted. Preventive measures have been applied. In these inspections a large number of corroded cables have been found. This has prompted a more elaborate investigation of the factors influencing the rate of corrosion and of the effectiveness of various corrective measures.

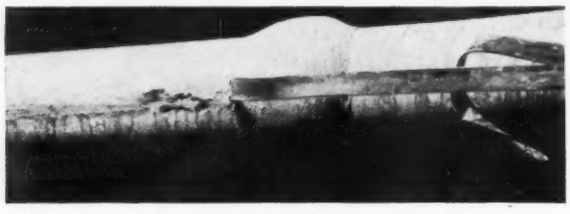
Several hundred samples have been prepared for determining the influence of such factors as the composition of the fireproofing material, the proportion of sand and cement, the influence of various other substances present in the cement, the comparative activity of different brands of cement, and the effect of varying degrees of moisture exposure, the method of applying and leading away the bond strap and the effectiveness of various types of protective coatings. These corrosion tests have been allowed to run from three months to more than three years. In a large number of these corrosion samples the actual rate of flow of



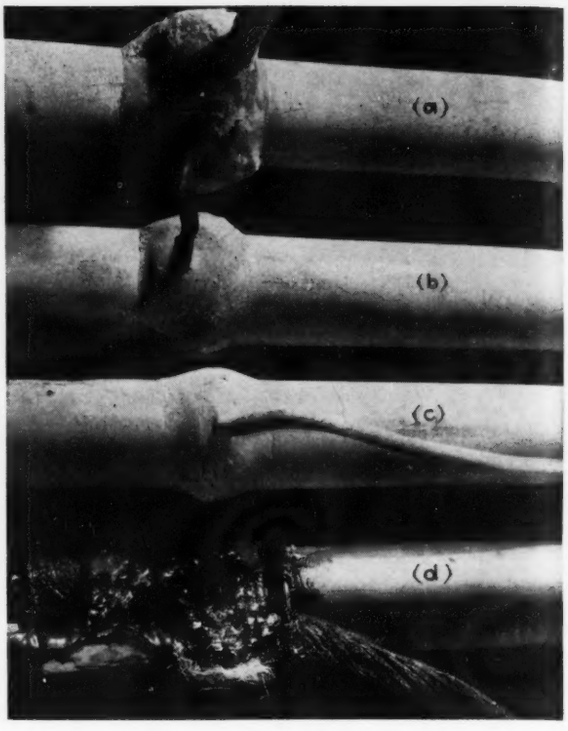


Cable failure results from extensive corrosion of sheath by galvanic action

Bond strap in contact with commercial cement fireproofing.



With bond strap parallel to lead one-year laboratory test shows severe corrosion. Cement-sand fireproofing applied over rope. Humid atmosphere



Preventive measures proved effective after one-year laboratory test

Cement-sand fireproofing in humid atmosphere.
(a) Stranded bond wire at right angles to cable. Practically no corrosion.
(b) Flat bond strap erect. Practically no corrosion.
(c) Bond strap with 1/16-in. lead coating. Practically no corrosion.
(d) Hot asphalt and muslin protective coating. Lead retained bright luster. No corrosion.

galvanic current has been measured over a long period.

Where the cables were almost continuously immersed in water little corrosion had taken place and also where the cables were very dry there was little corrosion, but where the cables were continuously damp the corrosion was severe. This apparently erratic effect of moisture is one of the important factors in causing variation in the presence of and degree of severity of this type of corrosion. Repeated measurements show that the galvanic current flows when the samples are first immersed in water and rapidly decreases to an extremely minute amount with the resultant stopping of the corrosion.

This practical freedom from corrosion where the cables are continuously and completely immersed in water has been demonstrated to be due to polarization of the copper electrode.

Hydrogen is liberated on the copper electrode and polarizes it. This film of hydrogen builds up an opposing electromotive force which reduces the flow of galvanic current to practically zero. If oxygen from the air has access to this electrode it removes the hydrogen by oxidizing it back to water.

In damp locations where appreciable corrosion occurs the rate of corrosion gradually decreases with time. The action is fairly rapid during the first few months, decreasing with a sharp rate for the next half year. Thereafter, the rate of corrosion slowly decreases, but in most cases appears to continue for an indefinite period. The hard coating of lead monoxide produced by the corrosion offers resistance against further action, tending to slow up the rate of reaction.

Various types of fireproofing tested

We have not yet received for test any type of commercial cable fireproofing material or any type or brand of cement which will not produce this type of galvanic corrosion under favorable conditions when a copper bonding strap is soldered to a lead cable sheath and imbedded in the fireproofing material along with the lead. There is, however, a very distinct difference in the rate and extent of corrosion produced by the different fireproofing materials. In general, the high alumina, early strength types of cement and a number of the special branded fireproofing materials low in calcium content are less active than the Portland cements.

Since this corrosion around the bonding strap is caused by the flow of galvanic current, its prevention lies in removing one or more of the fundamental constituents of the battery. This can be accomplished by eliminating one of the two unlike metals, or by keeping one of the two unlike metals out of contact with the electrolyte, by eliminating the electrolyte, eliminating the moisture, or by insulating one or both metals from the electrolyte. All of the preventive measures which have been used are based on one of these principles.

Preventive measures

The one most important step in prevention of this corrosion is to keep the bonding strap out of contact with the fireproofing material. This is accomplished to a large extent by bringing the bond strap straight up from the cable and bringing the wiping metal up around the copper to shield it from contact with the fireproofing. It is

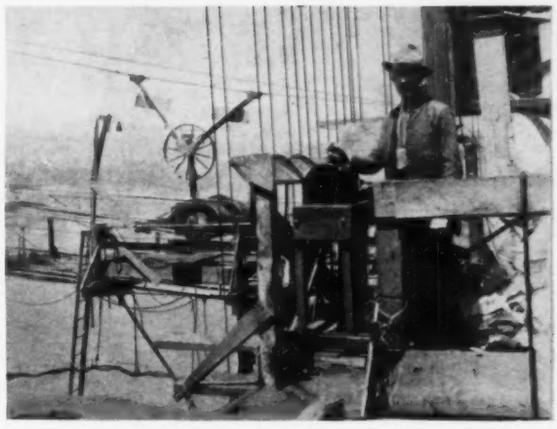
[*Continued on page 85*]

Rectifiers Reduce Control to Three Wires

Copper Oxide Units Afford 3-Wire Reversible Synchronized Control

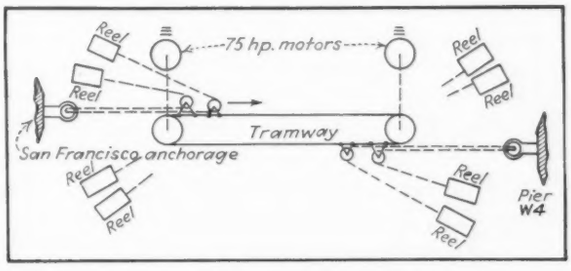
EACH of the cables supporting the San Francisco-Oakland Bridge consists of 17,464 parallel strands compressed and bound together to have an outside diameter of 28 in. To save time in spinning, but complicating the control problem, was the fact that it was decided to spin four wires at a time.

Inasmuch as the endless rope for each cable is driven by two 75-hp. motors placed 6,000 ft. apart, each of which must travel at the same speed and be capable of a fine speed adjustment, the control problem was one of considerable magnitude. Forward, reverse and speed control functions of the wound-rotor induction motor at the far end of the span from one operator's station on the center pier were accomplished by General Electric engineers using only three control wires by an ingenious application of two sets of copper-oxide, half-wave rectifiers. As shown, two half-wave rectifiers were connected in opposition at either end of one control wire, double-throw switches being provided at the control end.



Operator's platform located at center anchorage
One of the flying sheaves shown in the background

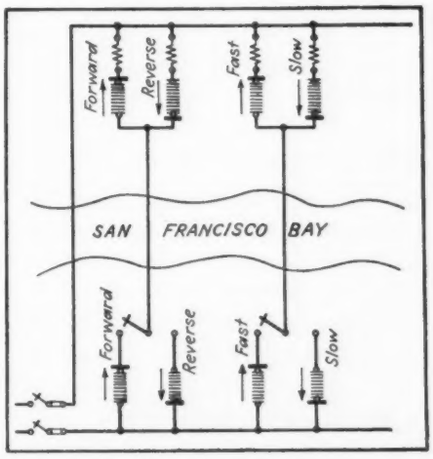
In the spinning operation on each cable there is an endless rope passing over driving sheaves at each end of the span, each driving sheave being connected to a 75-hp., wound-rotor induction motor operating at 440-volt, three-phase, 60-cycle power. At either end of this endless rope are fastened a flying sheave or "jenny." The endless rope is driven first in one direction and then in the other, carrying the flying sheaves backward and forward across the span. As each sheave moves across the span it carries the bights of two strands of wire. At the completion of the trip the two wires are fastened into position and two strands from that terminal are placed over the sheaves and carried back to the starting point. Thus four wires are laid for each trip across the span, two being carried from east to west and two from west to east.



Motors drive endless rope in spinning suspension cable

Half-wave copper oxide control unit permits selective operation of two controllers over a single control wire

In one position of the double-throw switch two of the half-wave rectifiers at either end of the span worked together, allowing current to pass through one contactor coil but, the other half-wave rectifier being in opposition, prevents energizing the contactor coil in that circuit. In the other position the reverse is true. Selective operation of the directional contactors is thus obtained for both the forward and reverse positions of the motor. For speed control motor-operated drum switches controlling the speed-regulating duty resistors were provided, the pilot motor on the drum switches being controlled in a similar manner as the directional switches. In the "fast" direction the operator merely selects the fast position of the double-throw switch and maintains contact until the pilot motors have moved the controllers to the desired speed, the pilot motor stopping on that point when the master switch is released. When the motors are de-energized the pilot motors automatically return to the "off" position of the controller. Moving the switch to the "slow" position reverses the direction of the pilot motor.



By means of sectionalizing segments on the motor-operated drum switches, the rotor resistances in the two motors are kept alike in order that the motor speeds will be approximately the same, this also being made possible over the single control wire over which selective operation for either fast or slow direction of the controller is obtained.

In the directional control wire a number of switches are connected in series along the span so that in case of trouble or emergency the men stationed along the span during the spinning operation can shut down the equipment. In this connection a small pilot light at the operator's control platform was connected through a 10,000-ohm resistance so that when all the switches along the span are closed sufficient current will pass to light the signal lamp, the amount of current not being large enough to energize the contactors.

The operator is located at the center anchorage in the middle of the bay and controls the entire operation from this point. When the west span is finished the control equipment on the San Francisco side, now remotely controlled from the center anchorage, will be moved to the far side of the east span. In this way the motors and remote-control equipment for one station only have to be moved to spin both spans. This method of obtaining directional operation and speed regulation with but three control wires undoubtedly will find wide application in other industrial projects.

Power Telemetered on Pennsylvania Line

Energy Metered at Seven Supply Points and Through One Tie Point and Indications Transmitted to Dispatcher for Guidance in Highly Important System Administration

By E. H. BROWN
Electrical Engineer's Office,
Pennsylvania Railroad

POWER for electric traction, signal and miscellaneous incidental purposes for the 11,000-volt, single-phase, 25-cycle a.c. electrified lines of the Pennsylvania Railroad is furnished at seven separate supply points. The locations (Fig. 1) are as follows:

1. At the Long Island City power plant of the railroad three turbo-generator units are equipped to supply about 9,000 kw. each for single-phase operation. One or more of these units can be used to feed into the 11-kv. concentric cable feeder system in the New York area for emergency service or to cut down the peak loads on the purchased power supplies.
2. At Metuchen, N. J., a 25,000-kw., 60/25-cycle frequency changer feeds from the Public Service Electric & Gas Company through a transformer station into the 132-kv. transmission system.
3. At Richmond Street, Philadelphia, two 30,000-kw., 60/25-cycle frequency changers feed the transmission system from the Richmond station of the Philadelphia Electric Company.
4. At Arsenal Bridge, Philadelphia, a 20,000-kva. transformer can be used for emergency supply from the 25-cycle bus of the Schuylkill station of the Philadelphia Electric Company.
5. At Lamokin Street, Chester, Pa., three 15,000-kw., 60/25-cycle frequency changers feed in from the Chester station of the Philadelphia Electric Company.
6. At Perryville, Md., four transmission lines supply power from the Safe Harbor plant of the Pennsylvania Water & Power Company. These lines are fed at Safe Harbor by a 28,000-kw., 25-cycle waterwheel generator and a 25,000-kw., 60/25-cycle frequency changer.
7. At Benning, D. C., one 25,000-kw., 60/25-cycle frequency changer feeds in from the Benning station of the Potomac Electric Power Company.

Under the present arrangements the purchased power is supplied under two contracts:

1. The power supplied between New York and Perryville, Md., on the Susquehanna River, including the supply points at Metuchen, Richmond, Arsenal Bridge and Lamokin. There is also included in this contract a power supply at Somerset Street, Philadelphia, which feeds into the transmission lines supplying the third-rail electrification of the Pennsylvania-Reading Seashore Lines out of Camden, N. J.

2. The power supplied between the Susquehanna River and Washington, D. C., including the supply points at Safe Harbor and Benning and a future supply at Loudon Park, in Baltimore, Md.

The transmission lines are normally operated as a continuous synchronized system between New York and Washington. Under this condition exact balancing at all times of load between the two contracting power supply systems is not possible and there is a continual swinging back and forth of load through the tie point at Perryville. Energy consumption is billed, therefore, on the basis of the territory in which it is used, which requires that the transfer of energy through the tie point be metered accurately. This is accomplished by local meters in the railroad company's substation at Perryville. The metering includes total energy consumption and hourly demand, for power flow north and power flow south, separately, both for active and reactive power.

With a transmission link as important as that serving the Pennsylvania's electrification it is essential that the dispatchers of the railroad and the supplying utilities know at all times what the loads and swings are. The best in telemetering has been installed to perform this function and the installation has real significance as an index of the growing development in this art.

In order to give proper continuous supervision to an electrified railroad 226 miles in length, with its paralleling transmission lines fed from seven supply points and feeding into 40 trolley substations and eight trolley switching stations, it can readily be appreciated that prompt indication of load conditions at the power supply points is important and all but indispensable to the railroad company's load dispatcher.

With this in mind a complete telemetering system has been installed which indicates the power being received from each point of supply of purchased power and the flow through the interchange point at Perryville. The load dispatcher is furnished with an illuminated model board, on which he manually sets up the position of all high-tension switching. He has a complete telephone system by means of which he is in direct contact with all power supply points and division power directors who supervise the local switching of the substation, trolley and signal circuits in their respective zones. The system load dispatcher is thus furnished with sufficient information for him to follow the load changes and the availability of transmission circuits which enables him to act promptly and intelligently under the conditions which he may be called upon to face.

The transmitting equipment used at Richmond, Somerset, Arsenal Bridge and Lamokin consists of a Lincoln thermal converter* with no moving

*See paper by P. M. Lincoln, "Totalizing of Electric System Loads," *A.I.E.E. Journal*, Vol. 48, February, 1929, page 129.

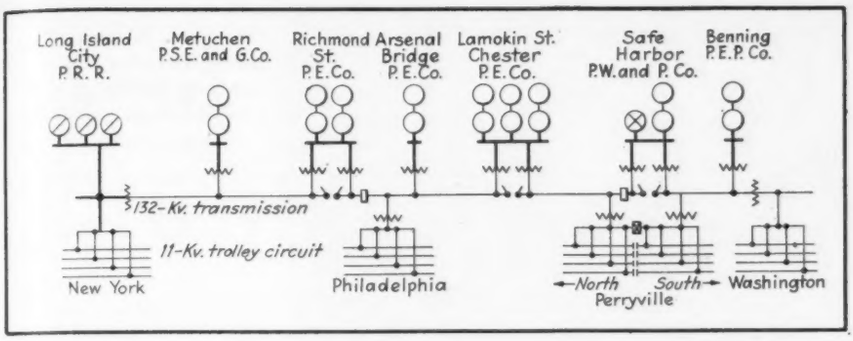


Fig. 1—Pennsylvania System takes energy at seven points

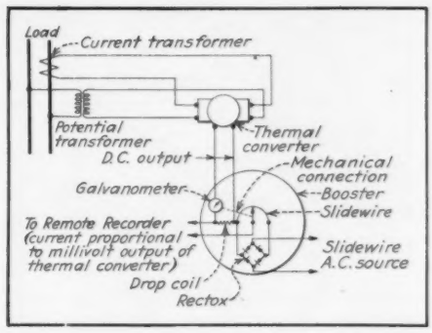


Fig. 3—Booster retransmits rectified current proportional to load

parts. A single converter is used at Richmond with two elements, one for each generator. At Lamokin a three-element converter is used with each element energized by one of the three generators. At Arsenal Bridge a single-element converter transmits the output indication from the single feeder. Two three-phase converters are used on the two outgoing feeders at Somerset Street, since the output at this point is three-phase, 25-cycle instead of single phase as at the other points.

At the above locations the output of the converter, a small d.c. voltage proportional to the power output, is put directly on the telephone lines. At Metuchen a single-element thermal converter is used to measure the generated output, and the output of this converter is applied to a "booster" near by which retransmits (Fig. 3) the indication as a small rectified current proportional to the load. The transmitting scheme at Metuchen, using current instead of voltage, was adopted because of the fact that this scheme is affected to a less degree by high induced potentials between conductors which may be encountered on this 64-mile circuit.

At Perryville, Safe Harbor and Benning the "torque balance" transmitter* is used. This type of transmitter supplies a d.c. current proportional to the power by means of pliotron tubes controlled by photoelectric cells which are operated by a light beam from a mirror mounted on the coupling between the power-measuring element and the restraining element so that the torque produced by the two elements is kept balanced. At Perryville a two-element transmitter measures the power flow through the two 132-kv. transmission circuits, and a single-element transmitter, with its output in parallel with the first,

*See paper presented by A. J. Johnston before A.I.E.E. convention at Cleveland, June 20-24, 1932.

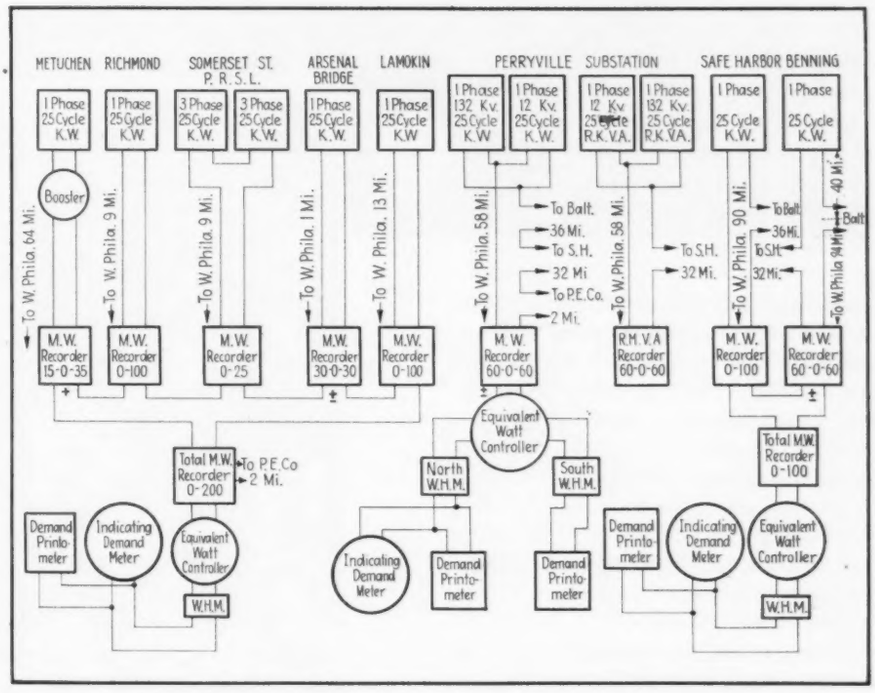


Fig. 2—Telemetering indications brought in to the load dispatcher's office

One pair of telephone wires used from each point except from Perryville, where two pairs are used, one for active power indication and one for reactive power.

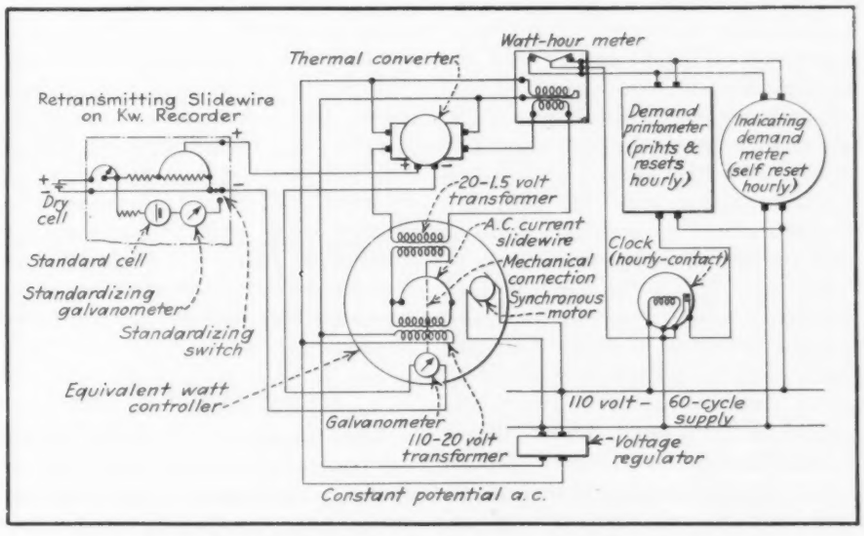


Fig. 4—Kilowatt-hours and hourly demand from proportionated alternating current

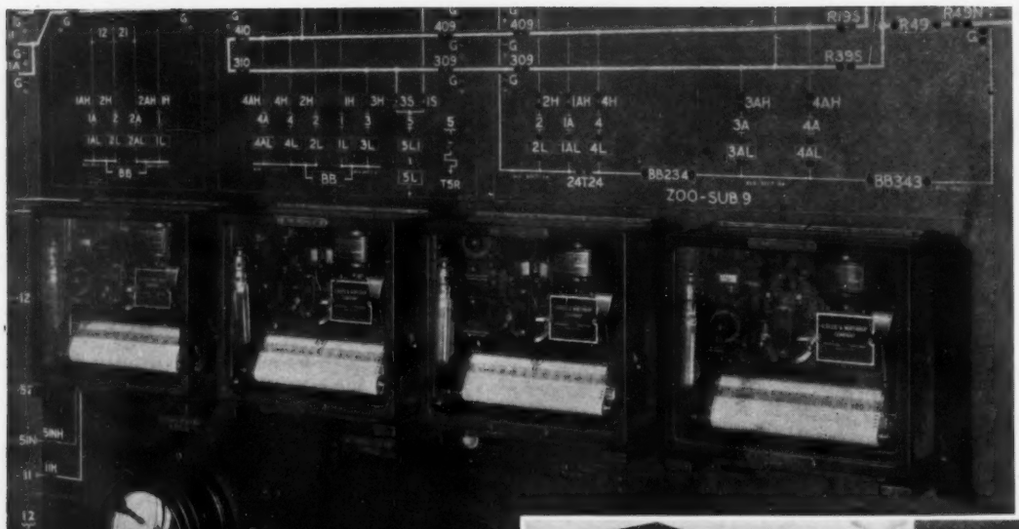


Fig. 5 — Micromax recorders in load dispatcher's office give totalizing and power interchange

Fig. 6 — Individual station load and demand recorders installed in load dispatcher's office

measures the power flow through the trolley bus tie. A similar arrangement is used to measure the reactive power flow. At Benning a single-element transmitter is used for the generator output. A torque balance retransmitter is used at Safe Harbor and receives its indication from a transmitter which totalizes the output to the railroad from the two generators for the power company's own telemetering system.

The output is carried from the transmitting points directly to "Micromax" recorders in the load dispatcher's office at West Philadelphia. For the power company's information, the interchange power circuit is looped into recorders in the Pennsylvania Water & Power Company dispatcher's office in Baltimore, the Safe Harbor operating room at Safe Harbor and the Philadelphia Electric Company dispatcher's office in Philadelphia. The interchange reactive power circuit is looped to the Safe Harbor operator, as is the Benning output. The Baltimore dispatcher also receives indication of the Safe Harbor and Benning outputs.

The recorders in the railroad load dispatcher's office measure the transmitted d.c. voltage. Where the transmitter output is a d.c. current the drop across a resistor is used to produce an equivalent d.c. voltage. These voltages are measured by "Micromax" mechanically self-balancing potentiometer type recorders and recorded in the units originally measured. In the case of Metuchen, Arsenal Bridge and Benning, where there is a likelihood of normal power reversal, the recorder indicates either side of zero to show power flow either into or out of the supply point. At Richmond, Somerset, Lamokin and Safe Harbor, where reversal is abnormal, the recorder indicates from zero to the maximum anticipated load. At Perryville, the interchange point, power flow must, of course, be recorded in both directions.

Totalizing also effected

The preceding description points out the method used for recording the load on each supply point and the interchange. For further use this must be totalized for each of the two contractual supplies and the kilowatt-hours and hourly demand recorded for each of the two contractual supplies and for the energy interchange both north and south at Perryville. Since only the kilowatt indication is received from each point this presented an interesting problem.

Totalizing is accomplished in a simple manner by mounting a "retransmitting potentiometer slide wire" on the back of the mechanism of each "Micromax" recorder. From this slide wire a voltage is obtained equivalent to the incoming line wire indication as the recorded reading changes. The voltages from the various slide wires on the station load recorders for each system are added and applied to another recorder which thus records

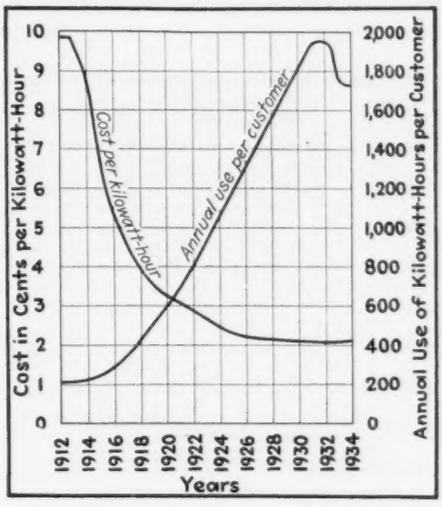
[*Continued on page 104*]

Load Building in the Northwest

Experience in Building Domestic Business in Pacific Northwest—Maximum Use of Ranges and Water Heaters

By BERKELEY SNOW

Executive Secretary Northwest Electric Light and Power Association, Portland, Ore.



Domestic service of the Washington Water Power Company

A SURVEY of load, appliance saturation and rate data covering a period of years in the ten largest privately owned utility companies and the three largest municipal enterprises in Oregon, Washington, Idaho, Utah and British Columbia has revealed some facts that may be of interest to those companies not so far advanced with the development of the domestic customer.

We find that the average annual domestic consumption as of January 1, 1935, among the three-quarters of a million customers of these thirteen companies serving this 90 per cent of this vast Northwest territory amounted to 1,116 kw.-hr.—this against a national average of 634. These customers paid an average rate of 2.91 cents per kilowatt-hour, against the national average of 5.28 cents. For this average service to the homes of the Northwest, which, indicated by kilowatt-hour use, is 76 per cent more service than that rendered the average of all the domestic customers of the United States, the customers in the Northwest paid a slightly smaller annual bill than the national average—$32.53 against $33.48. Since this high average annual use is based largely on electric cooking and water heating, it is of interest to note that practically one out of every four involved cooks with electricity, while nearly one out of ten heats water electrically.

Two important physical and economic factors contributed to the early development of domestic business in the Northwest. First, the territory outside the six fairly large cities is predominantly non-industrial. Limits in intense industrial electrification were quickly approached, and it was seen that future growth in the largest portion of the territory was destined to be in small towns and rural areas and not, generally speaking, along industrial lines. This meant a relatively large investment in distribution facilities per customer, creating a relatively high fixed charge that could be successfully met only by loading these facilities. The other factor was the preponderance of hydro-electric generation in the territory, which led managements early to think in terms of low-cost power, particularly that part of their hydro that was necessarily wasted down stream if it was not used at the moment of its availability. There were many other factors, of course, but the two fundamentals named above will furnish the background for accepting the premise that the companies in this territory early found it to their advantage to seek expansion of their businesses in the domestic field, and consequently bent much of their load-building efforts in this direction.

This article comes from a territory where ranges and water heaters have their greatest saturation. It gives a complete summary of domestic load building in the Northwest and shows how to "sell" homes. Lessons from these experiences can be used by all interested in load building.

Since this article is primarily concerned with the facts of the development rather than its causes, let us examine the data compiled in Table I.

Attempt was made to secure data from each company as of three dates in the fifteen-year period—January 1, 1920, 1925 and 1935. This was not entirely successful, as is noted in the table, deviations from columnar headings being indicated by footnotes, since the records kept by some companies ten or fifteen years ago were not of a nature to permit furnishing the data requested. Nevertheless, enough data of the earlier years are included to reveal the general trend and some significant individual performances. For instance, while company No. 2, one of the two that could supply the data as far back as 1920, was doubling its number of customers in the fifteen-year period, it increased the average consumption of all its customers, old and new, more than three times. That the ratio of its increase in average consumption during that period coincides very closely with the increase in the number of ranges on its lines expressed in a ratio may be significant.

Unfortunately the table cannot portray the many factors having a bearing on different company records. Thus the reader is cautioned against drawing hasty conclusions from comparisons. For instance, the table does not show that company No. 2 has reached a range saturation of 21 per cent in the face of stiff gas competition at reasonable rates, nor that company No. 7 with a saturation of 44 per cent has not only not had gas competition to any extent but, further,

Table I—Number of Customers, Range and Water Heater Saturation,

Ten Private Utilities and Three Municipals in Oregon,

No. in Order of Size	Number Domestic Customers			Number Ranges in Service			Per Cent Present Range Satur.	Number Water Heaters in Service			Per Cent Present W. H. Satur.	Average Annual Domestic Consumption		
	Jan. 1, 1935	Jan. 1, 1925	Jan. 1, 1920	Jan. 1, 1935	Jan. 1, 1925	Jan. 1, 1920		Jan. 1, 1935	Jan. 1, 1925	Jan. 1, 1920		Jan. 1, 1935	Jan. 1, 1925	Jan. 1, 1920
Private														
1.	143,698	*68,000	Not available	[1]28,964	*5,722	Not available	21	[1]10,339	*1,210	Not available	7.2	1,018	*457	Not available
2.	99,209	67,525	42,383	20,667	5,357	620	21	4,451	835	Not available	4.5	993	504	283
4.	76,377	44,346	[4]39,037	8,280	1,599	Not available	11	2,968	1,035	Not available	3.9	993	380	[4]350
8.	31,690	14,438	Not available	9,918	Not available	Not available	31	1,555	Not available	Not available	4.9	1,165	570	Not available
5.	51,511	Not available	Not available	15,074	Not available	Not available	29	11,884	Not available	Not available	23	1,610	*1,200	*600
3.	84,941	68,645	Not available	*24,000	*10,000	Not available	28	1,000	100	None	1.2	721	377	Not available
6.	43,548	27,461	Not available	7,821	1,970	Not available	18	3,960	844	Not available	9.1	1,405	393	Not available
7.	36,525	22,393	[10]21,577	15,975	5,674	[10]4,953	44	5,031	4,569	[10]4,069	13.8	1,220	[11]1,162	Not available
9.	20,653	[12]14,766	Not available	5,518	[12]2,050	Not available	27	3,022	[12]1,461	Not available	15	1,619	[12]1,216	Not available
10.	20,227	15,555	[13]9,249	4,670	Not available	Not available	23	856	Not available	Not available	4.2	859	426	[13]365
Municipal														
1.	79,624	73,537	56,845	26,541	4,850	954	33	15,280	2,500	424	19	1,050	428	298
2.	28,390	[15]27,707	Not available	8,640	[15]6,403	Not available	30	6,006	[15]4,400	Not available	21	1,554	[15]1,720	Not available
3.	6,700	Not available	Not available	1,980	477	21	30	[17]616	Not available	Not available	9.2	1,525	Not available	Not available
	723,093			178,048			24.7	66,968			9.2	1,116		

*Estimated. [1]June, 1934. [4]As of July 1, 1923. [7]Combination rate established, 1931. [10]As of Jan. 1, 1923. [13]As of Jan. 1, 1922.
[2]Established, 1930. [5]Established, 1928. [8]Established, Feb., 1934. [11]As of Jan. 1, 1928. [14]Established, June 3, 1935.
[3]Established, 1919. [6]Established, 1924. [9]Cooking sep. metered in some localities. [12]As of Jan. 1, 1926. [15]As of Jan. 1, 1929.

Average Domestic Consumption and Revenue, and Domestic Rates

Washington, Idaho, Utah and British Columbia

Average Annual Domestic Revenue			Earning Per Aver. Annual Kw.-Hr.			Domestic Rates			Water Heating Rates—Flat Rate		Metered Time Controlled
Jan. 1, 1935	Jan. 1, 1925	Jan. 1, 1920	Jan. 1, 1935	Jan. 1, 1925	Jan. 1, 1920	Jan. 1, 1935	Jan. 1, 1925	Jan. 1, 1920	Jan. 1, 1935	Jan. 1, 1925	Jan. 1, 1935
30.99	*24.68	Not available	3¢	5.54¢	Not available	40@5½¢ 200@2¢ Excess@¾¢	40@5½¢ 200@2¢ Excess@1¢	45@5½¢ Excess@2¢	None	$4 per kw. per mo.	0.75¢
30.89	24.00	17.95	3.11¢	4.76¢	6.34¢	[2]30@5½¢ 40@3¢ Excess@1.8¢	[3]13 for $1 7@7¢ 50@3¢ Excess@2¢	Same as 1925	$5 per kw. mo. unlimited $3.50 per kw. mo. limited	Same as 1935	0.8¢
22.85	19.59	[4]22.64	2.3¢	5.1¢	[4]6.4¢	[5]30 to 60@4¢ depending on area. Excess@2¢	[6]3 kw.-hr. per 100 sq.ft.@5¢ Excess@2¢	Block system of rates	$3 for 750 w. $4 for 1,000 w. $6 for 1,500 w.		0.8¢
34.36	25.80	Not available	2.88¢	4.53¢	Not available	30@5½¢ 40@3¢ Excess@1.8¢	9@8¢ 11@7¢ 50@3¢ Excess@2¢	Same as 1925	$5 per kw. mo. unlimited $3.50 per kw. mo. limited	Same as 1935	None
37.35	*30.00	*19.74	3.32¢	*2.5¢	*3.29¢	32@5½¢to 7¢ Excess@3¢	20-28@7¢ to 15¢ Excess@3¢	Same as 1925	$3.50 to $3.90 per kw. mo. limited	$3.50 per kw. 1 mo. limited	0.8¢
35.28	26.35	Not available	4.9¢	6.99¢	Not available	[7]$1.25 per room per mo. for 4 rooms—20¢ per month each addit. room—2.5¢ per kw.-hr. If water heater, 1½¢ per kw.-hr. for excess over 300 kw.-hr.					[8]$1 for 75 kw.-hr. plus 1¢ for additional kw.-hr.
40.97	26.78	Not available	2.9¢	6.8¢	Not available	30-38@7¢ to 8½¢ Excess@3¢	20-30@10¢ to 12¢ Excess@8¢ to 3¢ [9]Cooking@3.6		$2.25 for 600 w. $2.75 for 750 w. $3.25 for 1 kw. limited	Same as 1935	0.8¢
45.34	[11]43.92	Not available	3.8¢	[11]3.8¢	Not available	[12] [21]$3.50 mo. for 4 rooms, inc. 85 kw.-hr. 30¢ each addit. room 50@2.5¢, 50@2¢ Excess@1.5¢	10@10¢ 30@8¢ 30@5¢ Excess@4¢ [9]Cooking from 3¢ to 2¢	Rates higher and not uniform	*1½¢ per kw.-hr. (metered)	0.6¢ to old customers 1¢ to new cust. (metered)	None
42.01	[12]33.63	Not available	2.59¢	[12]2.76¢	Not available	30@10¢ 200@2¢ Excess@1¼¢			Limited = $3.50 per kw.-mo. unlimited = $1.00 plus 0.004 per watt (uncontrolled)		None
32.40	24.90	[13]24.29	3.77¢	5.84¢	[13]6.65¢	30@8¢ Excess@3¢	15@10¢ 15@7¢ Excess@3¢	Lighting—from 11¢ to 5¢ in several steps—cooking from 4½¢ to 2½¢	$3.50 per kw. mo.	Same as 1935	None
29.83	17.25	14.18	2.84¢	4.03¢	4.76¢	[14] [22]40@5½¢ 200@2¢ Excess@¾¢	40@5½¢ 200@2¢ Excess@1¢	45@5½¢ Excess@2¢	For 4 mos. serv. $5.50 per kw.-mo. For 12 mos. serv. $4 per kw. mo. Both unlimited	Same as 1935	None
26.52	[15]26.14	Not available	1.7¢	[15]1.5¢	Not available	House area rate 32 (plus) @4½¢ [16]500 @1¢ Excess@½¢			No spec. rate		None
33.53	Not available	Not available	2.2¢	Not available	Not available	[18] [19]10 = .75 15@4¢ 25@3¢ 125@2¢ Excess@¾¢			[20]$3.50 per kw. mo. limited or [23] 1¢ per kw.-hr. metered		None
32.53			2.91¢								

[16]Changed from 800 to 500, Jan. 1, 1935.
[17]Average for year—maximum 950.
[18]All electric home rate, established 1934.
[19]New residential lighting, established May, 1935, runs from 7.5¢ to 1.4¢ bottom in four steps.
[20]When used with residential lighting.
[21]Combination lighting, cooking, and for water heating, established, 1927.
[22]Reduced during 1935.
[23]When used independently of other schedules.

has enjoyed a comparatively favorable situation with respect to the cost of other competitive fuels for cooking. Incidentally, company No. 4, having the lowest range saturation, is the only combination gas and electric company listed, and unquestionably this has had a bearing on the intensity with which it has pursued the electric range business. Municipal No. 2's average consumption contains some house heating, but how much is not known.

By and large, the companies having high range and water heater saturation are shown to have the highest average consumptions. But the table shows deviations from this general rule; for instance, company No. 3's high range saturation with the lowest average consumption of the group and company No. 6's moderate saturation in both water heaters and ranges with a high average consumption. But here again many influencing local factors, only to be brought out by painstaking analysis of each individual case, will explain these apparent inconsistencies. For one thing the saturation of electric refrigerators, another excellent load-building item, is not recorded, and, further, the number of flat rate water heaters on a company's lines and the manner of installation of those heaters —whether the tanks were lagged or not—and the manner of estimating the kilowatt-hour consumption of such heaters in the absence of definite meter records all have a bearing on the final results. I believe it is accurate to state that the companies having the higher annual consumptions are the companies having the greater number of flat rate water heaters on their systems, and that, were these water-heating installations all of the automatic, thermostatically controlled, insulated design now being installed generally throughout the territory, the average consumptions of such companies would be somewhat less without in any way curtailing the quantity of service rendered the customer.

While the rate data portrayed in Table I do not presume to set out each company's entire domestic rate structure, they do represent the rates on which much of the domestic service of the companies, particularly the high use service, is billed. The attempt was made to indicate the trend of rates in the fifteen-year period under consideration, and examples will be seen in which top steps have been reduced by either shortening the step or lowering the price or both, and bottom steps have undergone reductions by the same process. Early experiments in inducement rates took the form chiefly of special rates for electric cooking through a separate meter. Lately, however, the tendency has been toward combining all domestic service under one meter, and a few companies maintain special rates for combination use of lighting, cooking, refrigerating, etc., not available to customers desiring to use only lights and small appliances. There has also been a tendency toward making rates uniform throughout the entire territory served by a company.

In the field of water heating, the trend away from flat rates toward time-controlled metered service is noted and it should be stated that the six companies now offering this metered service at rates from $\frac{3}{4}$ to 1 cent have put these rates into effect within the last three or four years.

Methods and practices

In connection with furnishing the data compiled in Table I, the companies were asked to comment on the causes back of the development of their domestic business. The answers show a uniformity with regard to rate reductions, continuous selling efforts, campaigning, advertising and general consistent promotion, but a rather wide variety in methods, practices, terms, extent of dealer co-operation and other devices through which these efforts have been applied. One municipal mentioned the continuous improvement in appliances as a factor contributing to the development of domestic load.

Individual company policies and sales practices have changed with the change in times and have been governed very largely by conditions in the local market involving competition, wealth and purchasing power of the communities, presence or absence of live, up-to-date appliance dealers outside of the utility companies and other influences. Prices of major appliances have for the past several years been maintained at manufacturer's list pretty generally throughout the territory except in Seattle, where a smaller mark-up has prevailed—a policy dictated by the municipal system there. Terms have varied with the years and, generally speaking, have followed accepted good business practices in respect to carrying charges. Tendency recently has been to lengthen time periods of contracts, and within the past year the introduction of five-year terms on certain specified ranges and water heaters has appeared in some localities. Once or twice in the past an outright rental plan for water heaters has been tried, but later abandoned. At present what amounts practically to a rental-purchase plan on water heaters is in effect in two or three localities.

The device of offering premiums with electric ranges, while tried during campaigns many years ago, has generally been abandoned, and free range wiring in some localities, and in one instance a free energy credit, is now the nearest approach to the offer of premiums that is noted in the territory. Some companies have offered free range wiring only during one or more periodic campaigns during a year. Others have adopted the device as a matter of presumably permanent company policy, either capitalizing most of this cost or charging it all directly to the cost of merchandise sales. One company, having developed in 1929 a portable range-wiring assembly to which title was retained by the company and which could be, though seldom was, moved from house to house, is still installing this device free for practically all its range installations to old homes. Some companies are opposed to this policy in principle and do not find it necessary to offer this inducement to place ranges on their lines.

A wide variety is also noted in the matter of co-operation with dealers, though by and large throughout the territory a considerable measure of co-operation is offered. One company has practically ceased merchandising any appliances except small appliances over its counter and now places all the sales of major devices developed by its own sales promotion crew through the active dealers in the community which maintain outside sales staffs. Far to the other side of the fence is one company which, after trying a measure of co-operation and not securing the results it desired, has now practically frozen the outside dealer out of the range business, though it does offer a very considerable co-operation with dealers in the matter of lighting and other load development programs. Between these two, many degrees of dealer co-operation are in effect, one of the most elaborately worked out being the Electrical Equipment Sales Association in the territory of the Idaho

Power Company. There in 1936 the volume of range sales and consequent estimated annual revenue from such sales to be placed on the lines of the company by dealers is expected to be double the volume added by the company's own sales force.

Something of the sales philosophies of the different companies and the methods by which load has been added and is now being added can be gained from the extracts from the comments by the sales managers of the different companies, as follows:

TOM D. FULFORD, *Puget Sound Power & Light Company*—The groundwork for our domestic development was laid in 1912. Then in 1914 we adopted a rate of 3 cents per kilowatt-hour for domestic cooking and heating, and in 1915 a rate of $3.50 per kilowatt per month for water heating. Coming down to the period from 1920 to 1935, inclusive, we began our most active work in 1924 after the post-war depression. In almost every year of this period we reduced domestic rates, either in all or a part of our territory, with the result that the maximum rate for the first step is 5½ cents uniformly throughout our territory, including the most remote rural districts. In addition to reducing lighting rates, we adopted in 1931 a new rate of 0.8 cent per kilowatt-hour for time-controlled water heating, and in May, 1932, reduced that rate to ¾ cent. The average rate for all domestic service was reduced about 65% between 1920 and 1935.

Each year of the period from 1924 to 1930 two intensive sales campaigns for 45 to 90 days each were carried on covering ranges and water heaters, except in 1927, when there was one such campaign. It was necessary to curtail such intensive sales work from 1931 to 1933, inclusive, but it was resumed in 1934, and culminated in 1935 in the most ambitious sales program that the company had ever undertaken.

In connection with our advertising and sales talks, we devoted several years to finding out what particular objection women had to the electric range, such as high first cost, high operating costs, not dependable, too slow, etc. We then drafted our advertising and sales talks to overcome such objections one by one.

We have always sold ranges at a price well above cost, excepting for a few short periods of intensive competition. We have always offered liberal terms to customers with good credit, varying from time to time from twelve to 24 months, and in our 1935 plan our terms were up to 60 months.

Our present plans offer a substantial bonus to dealers for range sales and for water heater sales. This is part of quite an elaborate plan of dealer co-operation and we hope it will produce some results, though our experience in the past with the sale of ranges and water heaters by dealers has not been altogether satisfactory.

A. C. MCMICKEN, *Portland General Electric Company*—We actually started promoting electric ranges about 1911 in a small way and did a fairly good job during the years 1915 and 1916 when the World War made securing electric ranges practically impossible and our range selling activity was, therefore, dropped and not resumed until the summer of 1921. At that time we had approximately 800 ranges on our system and between the summer of 1921 and the end of 1934 we had built this number up to 20,667. Not until 1927 did dealers commence to sell any appreciable number of electric ranges. We have tried to co-operate with dealers by maintaining list prices and terms which dealers could meet. During the past few years approximately half of the ranges going on our lines have been sold by dealers.

P. M. PARRY, *Utah Power & Light Company*—The company has always kept a comparatively large and aggressive domestic sales force, with domestic salesmen employed in all divisions throughout the territory, one salesman for each 1,500 to 2,000 domestic customers. Salesmen's pay is based on a small base salary, but with total compensation largely dependent upon the volume of sales made by each.

The company has maintained regular prices at all times, putting its main effort on the development of electric range and electric water heating service, and also being active in the promotion of electric refrigeration. Terms have been extended on major equipment, but not to exceed 24 months. Sales campaigns have been laid out at the beginning of each year stressing various types of equipment during various months of the year, with due regard for the seasonable periods for equipment, but at the same time attempting to develop an all-year-round campaign. The result has been that, although sales of certain equipment increase during the summer months, the major devices such as ranges, refrigerators and water heaters, have been sold through all months of the year.

During the last two years the company has maintained a dealer co-ordination department, which has been particularly active during the latter part of 1934 and 1935 toward the end of working with and co-ordinating the efforts of all dealers throughout the territory.

W. C. MAINWARING, *B. C. Electric Railway Company*—The company has, since prior to 1912, participated actively in the merchandising of electrical appliances and maintained sales rooms at strategic points, having eight at the present time. For the past twenty years the company has maintained a force of outside salesmen, varying in number and reaching as high as 100. At the present time there are 42 outside salesmen employed. These men are employed on a salary and commission basis and are divided into crews, each crew specializing on certain types of appliances; i.e., range and water heater crew, radio and refrigerator crew, etc. Besides these crews approximately 33 salespersons, including store managers, are employed in the eight salesrooms.

A substantial mark-up has been maintained on all merchandise sold by the company excepting for storage water heaters and one model electric range, which is featured in our long-term purchase plan. These two exceptions are handled on a smaller margin. Terms range from ten months on some items, as small radio sets, to eighteen months on most of the larger appliances, though some refrigerators are sold on 36 months' basis, and up to 65 months on one model of range. Storage water heaters are sold on the rental-purchase plan with rental spread over as long as 72 months.

In past years it has been the standard practice to have active sales campaigns on various appliances, arranged for over a specified period of time, between one and three months. We are gradually drawing away from this policy and putting into effect continuous sales efforts on which activity is maintained all year, or at least for six or eight months, as in the case of refrigerators.

Prior to 1933 no dealer co-operation plan was offered by the company in any form. List prices on appliances were maintained, so that there was no direct advantage held by the company, excepting that we were able to offer convenient terms which the average dealer could not meet.

In 1933 the company held a range campaign, in which free wiring was featured. The average cost of this wiring was approximately $40, and for all range sales made by dealers the company paid $25 to the dealer toward his cost of wiring. The following year, in place of free wiring, a free energy credit of $45 was offered, and this offer applied on ranges sold both by the company and by the dealers.

In 1935 the plan was further amplified and dealers received a straight bonus of $12 for any range prospect, when sold, or range order which they wished to turn in to the company for either the long-term purchase model or any standard model. The same plan was applied to dealers and plumbers on storage water heaters.

It is our policy to increase dealer co-operation, particularly on those appliances which offer difficulties in handling direct by the smaller dealers due to low margin, excess installation costs, etc.

The development of domestic business has been fostered in every way possible, among which the following may be mentioned: Maintenance of an efficient home service staff, home light service, free tube testing service, appliance repair department, suburban and rural cooking schools, co-operation of electric service league and home modernization bureau.

R. B. MCELROY, *Washington Water Power Company*—This company has actively merchandised for the past twenty years and has always attempted to co-operate with and build up as many dealer outlets as possible, which is no doubt one of the basic reasons for the high kilowatt-hour consumption per residential customer.

L. W. BRAINARD, *Idaho Power Company*—Our territory is not an industrial territory, and so it has been necessary for us to effect increases in revenue from the development of our domestic market, approximately one-third of which is rural. The main factors in this development have been the constant extension of our lines into new rural territory, with major emphasis given to the development of our domestic cooking load, which has been increased to slightly less than 50 per cent saturation.

The principal sales features in the accomplishment of this domestic load building have been all employee activity and maximum dealer co-operation. In connection with the latter it may be of interest to note that in our development plans for 1936 we expect to record dealers' sales of appliances and estimated annual revenue therefrom in an amount double those of our own sales staff.

The results have been accomplished through constant, continuous sales effort over a long period of time without the use of abnormally extended terms, free wiring or rentals, many of which have been tried by some companies as a short-cut to secure maximum results in a minimum length of time. It has always been, and still is, our opinion that electric service and the appliances necessary for its use are sufficiently appreciated and of sufficient value that both the appliances and service can be sold and that it is not necessary to give them away.

GEORGE H. WISTING, *Northwestern Electric Company*—In 1921 there were 416 ranges on our lines. Shortly thereafter we undertook to advertise the effectiveness and satisfaction of electric cookery through wider use in apartments. The results of this campaign were that 56 per cent of all apartment houses in Portland are using electric ranges.

The advertising features of the electric range embraced cleanliness, ease of operation, controlled temperature and economy of operation. Through a questionnaire sent to our customers we discovered that the three most important considerations of electric cookery were price of the equipment, cost of operation, and speed, and we therefore stressed these facts in advertising.

[*Continued on page 105*]

New Device

By S. MURRAY JONES
of Edward J. Cheney, Consulting Engineer, New York

Fig. 1 — Bill frequency analyzer gives block consumptions

Number of monthly billings in each kilowatt-hour step from 0 to 300 obtainable in one record from machine with 100,000 limit in each block. Record obtained at conclusion by rollers making impression through carbon paper.

IN THE spring of 1935 the Pennsylvania Electric Company was faced with the necessity of making certain rate changes and making them promptly. It had decided upon the approximate amount of revenue reduction and had agreed to simplify its rate structure as much as possible. There were in effect at that time ten different residential rates. Most of them were available in particular districts and were the same or similar rates which had been in effect prior to the merger of these districts with the Pennsylvania Electric Company. Before the merger these districts were in reality separate companies.

As rate consultants for the company, we were called in to make the necessary studies and develop rate proposals. The immediate requirement involved the analysis of more than a million bills for the twelve months of 1934. No partial analysis was given consideration, since the use of data based upon so-called typical months, such as April and October, or December and June, or other methods of making a partial analysis, have proved increasingly unsatisfactory to commissions and utility companies alike. The use of typical months has been particularly undesirable during the depression, when seasonal trends have not been constant. Furthermore, the annual load curve of the individual residential user has lost much of its conventionality as the result of aggressive load-building promotion of refrigerators, ranges, radios, water heaters, clocks and other appliances. Therefore, the "typical" month has become a progressively less dependable index of annual usage, and there appears to be no assured and accurate substitute for the detailed analysis of a full year's bills.

This work came at a time when both the company's staff and ours were extremely busy. Thus, we turned to the Recording & Statistical Corporation to make the analysis on its new bill analyzer, shown in Fig. 1. The Pennsylvania Electric Company's audit sheets for the year were turned over to the statistical organization. The individual consumption for each bill was directly listed in one operation for each rate, on the new accumulating machine. From the resulting tabulation of bill frequency—total number of bills for each consumption block—the Recording & Statistical Corporation prepared the customary summary of the total kilowatt-hours in each one kilowatt-hour block of consumption, as well as the cumulative totals.

Final analysis of these one million bills was received approximately three weeks after the job was started. The accuracy is evidenced by the fact that the company's actual revenue from all rates and districts was $3,825,980 and the revenue as calculated from the bill analysis was $3,800,741, a difference of less than 1 per cent, with which the Recording & Statistical Corporation was not wholly satisfied since it usually works to a closer margin of accuracy.

The striking economy and simplicity which this new method of billing analysis brings to a task which is usually expensive and burdensome led us to study all the advantages of the method in comparison with those customarily employed, and to wonder why, in view of its simplicity, some of the many rate engineers had not thought out and developed this idea before.

Now that rates are steadily affording narrower margins of income, it becomes more important than ever to analyze carefully the effect of any proposed rate changes. To do this it is essential to have complete and accurate bill analysis data for the calculation of proposed rates and the determination of their revenue effects.

Having been engaged in rate studies, rate adjustments and negotiations for many years, the author's firm is directly interested in any methods or procedure of preparing data for such studies which will assure accuracy, expedition and lower costs. An entirely new mechanical device for accomplishing these objectives came to the attention of the author when about to make a study for one of the firm's clients, the Pennsylvania Electric Company.

Different methods of making a bill analysis

A bill analysis tabulation is ordinarily made either by the hand method, employing tally sheets on which each individual bill is posted, or by the punch card method, by which the monthly consumptions for each customer are punched on a card, sorted and tabulated by Hollerith or Powers machines. The new machine introduces a third method by providing a device which combines the functions of an ordinary adding machine

Speeds Rate Analysis

Appreciably Lower Costs, Quicker Results and Avoidance of Staff Increases Show the Superiority of New Machine Method Over Prevailing Methods of Consumption Analysis

with those of a unique multiple-bank counter, which classifies and tabulates the bills of different sizes in one operation.

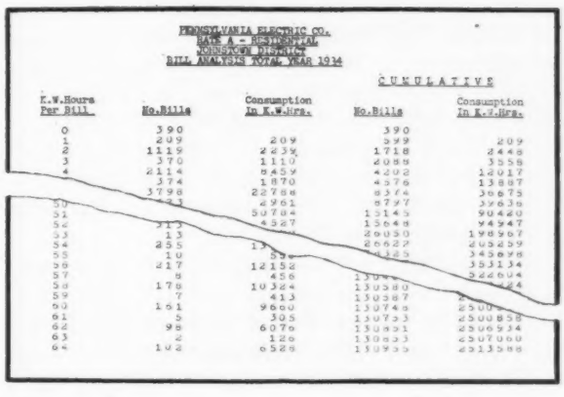
Hand Analysis Method—While the hand method can produce the same finished bill analysis as any other method or mechanical device, the task, involving, as this job did, about one million bills, is so burdensome that there is a temptation to short-cut it. Instead of carrying the analysis down to single kilowatt-hours steps, as shown in Fig. 2—the final summary sheet for one of the rates studied—it is often limited to steps of 5 or 10 kw.-hr. or more, or by other short cuts, which reduce the time and labor for making the analysis—but at a sacrifice. Obviously, where the amount of the rate reduction is limited and is not a large percentage of the total revenue, or where it is desired to accomplish a given objective in the simplification of rate structures, or in this particular case, where both were involved, many different suggested rates must be tried before the final one is agreed upon. In order to eliminate estimates as far as possible, and to obtain the most accurate results, it was desirable to have the analysis in 1-kw.-hr. steps, up to at least 50 kw.-hr., which for residential customers accounts for a large percentage of the total bills.

By far the greatest disadvantage of the hand method on an analysis involving a large number of bills is the extraordinary clerical burden which it imposes upon the operating company. Clerks must be withdrawn from other departments for what to them is unaccustomed work, or a separate organization such as ours must be brought in, or a combination of both must be employed. In either case, if the results are to be obtained promptly, it is frequently necessary to bring in temporary, untrained employees, with the consequent problems of supervision. Decidedly this means liability to error. There is no practical method of locating errors in the hand analysis method except by duplicating part or all of the work, which, of course, consumes time and adds to the expense. With such a large number of bills as was involved in this job there would be a tremendous number of tally sheets to be handled and summarized, with a very real possibility of errors which would have to be located.

Finally, the cost of such hand tabulation actually is appreciably higher than any apparent expense, due to supervision, overhead and the difficulties of costing the time of clerks borrowed

Fig. 2—Final bill analysis for one residential rate

The number of bills from the machine in Fig. 1 is multiplied by kilowatt-hours to obtain total consumption in each block. From this record cumulative totals of bills and kilowatt-hours through each step are prepared.

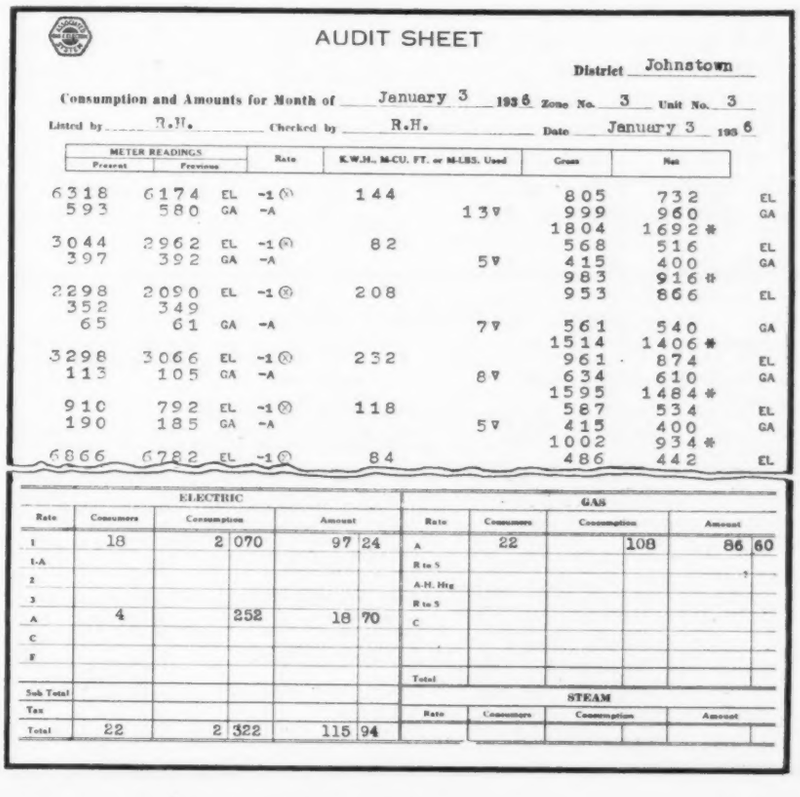


PENNSYLVANIA ELECTRIC CO.
RATE A — RESIDENTIAL
JOHNSTOWN DIVISION
BILL ANALYSIS TOTAL YEAR 1934

K.W.Hours Per Bill	No.Bills	Consumption In K.W.Hrs.	Cumulative No.Bills	Cumulative Consumption In K.W.Hrs.
0	390		390	
1	209	209	599	209
2	1119	2429	1718	2446
3	370	1110	2088	3556
4	2114	8459	4202	12015
	374	1870	4576	13885
	3798	22788	8374	36673
	783	4961	9157	41634
50		50784	13143	90420
51	313	4587	13456	94947
52	13	676	13469	95623
53	13	689	13482	96312
54	255	13770	13737	110082
55	10	550	13747	110632
56	217	12152	13964	122784
57	8	456	13972	123240
58	178	10324	14150	133564
59	7	413	14157	133977
60	161	9660	14318	143637
61	5	305	14323	143942
62	98	6076	14421	150018
63	2	126	14423	150144
64	102	6528	14525	156672

Fig. 3—Basis of analysis is typical monthly audit sheet

In this case the gas and electric bills were both on the audit sheet, but only the electric data were extracted by the machine operator.



AUDIT SHEET

District Johnstown

Consumption and Amounts for Month of January 3 1936 Zone No. 3 Unit No. 3

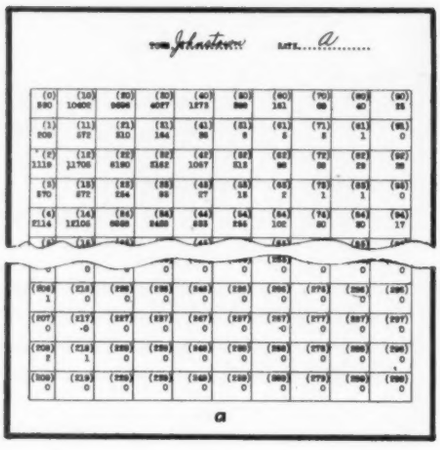
Listed by R.H. Checked by R.H. Date January 3 1936

Meter Readings Present	Meter Readings Previous		Rate	K.W.H., M-CU. FT. or M-LBS. Used		Gross	Net	
6318	6174	EL	-1 Ⓚ	144		805	732	EL
593	580	GA	-A		13 ▼	999	960	GA
						1804	1692 *	
3044	2962	EL	-1 Ⓚ	82		568	516	EL
397	392	GA	-A		5 ▼	415	400	GA
						983	916 *	
2298	2090	EL	-1 Ⓚ	208		953	866	EL
352	349							
65	61	GA	-A		7 ▼	561	540	GA
						1514	1406 *	
3298	3066	EL	-1 Ⓚ	232		961	874	EL
113	105	GA	-A		8 ▼	634	610	GA
						1595	1484 *	
910	792	EL	-1 Ⓚ	118		587	534	EL
190	185	GA	-A		5 ▼	415	400	GA
						1002	934 *	
6866	6782	EL	-1 Ⓚ	84		486	442	EL

ELECTRIC Rate	Consumers	Consumption	Amount
1	18	2 070	97 24
1-A			
2			
3			
A	4	252	18 70
C			
F			
Sub Total			
Tax			
Total	22	2 322	115 94

GAS Rate	Consumers	Consumption	Amount
A	22	108	86 60
R to S			
A-H. Htg			
R to S			
C			
Total			

STEAM Rate	Consumers	Consumption	Amount



a

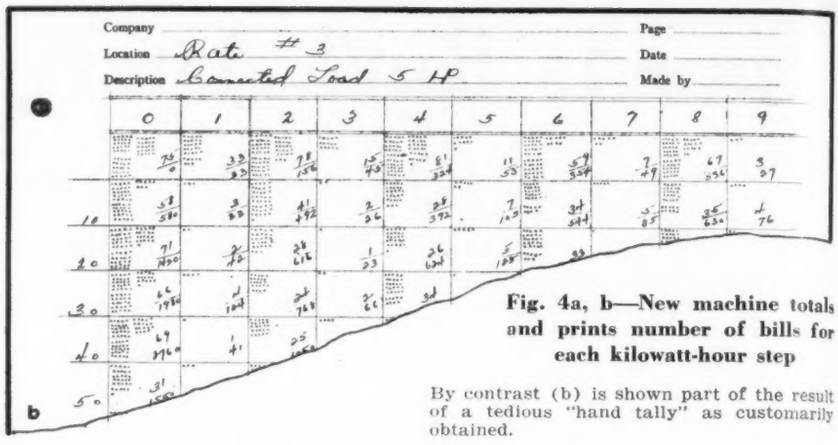


Fig. 4a, b—New machine totals and prints number of bills for each kilowatt-hour step

By contrast (b) is shown part of the result of a tedious "hand tally" as customarily obtained.

from other departments. For these and other reasons, many companies have turned to the punch card method for bill analyses, utilizing either their own equipment and organization or employing an outside organization.

It should not be inferred, however, that the hand method may necessarily be entirely superseded by either the punch card or this new machine method. There may still be many applications where the hand method will be the most economical, particularly where the number of bills to be analyzed is small and can be done by the local organization.

Punch Card Method—Punch card machine methods have happily met the requirements of speed and accuracy in many cases. It is customary to work from the meter books, provided kilowatt-hour differences are shown, or, if not, from ledger pages, in order that each customer's consumption for all of the twelve months may be recorded on one card. Practical experience proves that costs increase out of all reasonable proportion if an attempt is made to work from monthly records such as the audit sheets or billing register. The cost of the punch card method increases quite rapidly as the number of rates or districts into which the analysis must be divided is increased.

This method, under ordinary circumstances, permits work to a greater degree of accuracy than the hand tally method, but ordinarily it requires the employment of skilled operators at every point where meter books are stored. Sometimes the records can be photographed or sent to a central point for punching and tabulating, but this increases the expense somewhat.

New R & S Method—The marked advantage of this new method is that the basic record used is the monthly register of billings, variously known as "proof of billings," "audit sheet" or "production register." This, as shown in Fig. 3, is a normal record in utility billing systems, except where hand billing methods are still in use. In regular procedure, this record is filed away after billings have been proved correct, so that it can be released and sent to a central point for analysis, without interrupting operating routine and without any preparatory work on the part of the utility. Should release not be practicable, the records can be reproduced readily at nominal expense by the photographic method. In the absence of a billing register it is possible to work from a photographic reproduction of the meter books, or, in hand billing, from the customer's ledger sheets.

On this new machine the monthly kilowatt-hour consumption is directly recorded on a modified adding machine which produces a tape, listing consumptions in the same sequence as the original record, for verification and complete control. The adding machine is wired to electrical counters which automatically list a count of the number of bills in each kilowatt-hour step, shown by Fig. 4a, which is the summary sheet as it comes from the machine. Thus, in a single, direct operation the total number of bills for each kilowatt-hour step is obtained. It has a further advantage over other machine methods in that the cost of obtaining the bill frequency analysis is not appreciably increased for any given number of bills, whether one rate or more than one is involved, or whether the analysis is made as one total, or broken down by districts or towns. The cost of the final cumulative bill analysis is increased somewhat as the number of separate summaries is increased, but in not nearly the same proportion as with other machine methods.

In this new procedure, as in all except the punch card method, an operator calculates, from the bill count by size, the total consumption for each step and the cumulative totals for the final bill analysis summary. As a matter of control, the sum of the kilowatt-hours calculated from the bill frequency analysis must equal the total on the adding machine tape.

[*Continued on page 107*]

Comparison of Bill Analysis Methods

	Hand Method	Punched Card	R & S Bill Frequency Analyzer
Basic Record	Meter Book or Register of Billings	Meter Book (Register of Billings not used since it has only one month's record for each customer.)	Register of Billings or Recordak Copy of Meter Book
Clerks and Equipment	Time usually compels use of many temporary and inexperienced clerks. Large number of tally sheets required	Experienced staff using punches. sorters. tabulators. (Card must carry twelve monthly consumptions, because if twelve cards are punched for one customer the cost is excessive.)	Experienced clerks and one type of special machinery designed for the work.
Operations	1. Hand tabulation of billing kilowatt-hours. 2. Totaling intermediate summaries of bills. 3. Combining intermediate summaries. 4. Calculating final summaries of total consumption for each step and cumulative totals.	1. Card punching of billing kilowatt-hours. 2. Card sorting. 3. Tabulating final summaries, including cumulative totals.	1. Tabulating billing consumption. 2. Calculating final summaries of total consumption for each step and cumulative totals.

Selling Power to Industry

Day of "Come and Get It" Is Over—New Approach by Market Analysis and Knowledge of Industry—Organized Selling Will Get Results

By WALTER S. FINLAY, Jr.

THE relative importance given to organized sales effort in any industry obviously varies, not only with the actual need but with the extent to which that need is appreciated by those in whose hands the responsibility for the success of the industry rests.

It is sales effectiveness, reflecting both ability and appreciation of a need, that is back of far Western fruits and vegetables successfully competing in an Eastern market with the produce of Eastern growers—in season and out. It is that same sales effectiveness that within the passing years has tremendously built up manufacturers of automobiles, of chemicals, of steel—in fact, of a broad range of products—while their less aggressive competitors have passed into the limbo of things forgotten.

Accomplishments of this kind have not been the result of any specific form of sales activity. An organization can buy its way into the poorhouse as the result of an overambitious advertising campaign unsupported by a properly organized sales service. The absolute essential to success in bringing about the maximum use and sale of a product is a completely rounded-out and never-ceasing selling plan, organized from cellar to garret. For a relatively brief period in their early years the producers of electric power had to fight to market their product. Then came the flood! And the nation's business, stimulated by the discovery of what, overnight, had become an essential need, created a precedent and a history for electric power selling, which gave an appearance of a perpetual golden glow to his market, as viewed by the power salesman.

That day of "come and get it" is over. If we had been possessed of foresight to the extent that we are of hindsight, we would have appreciated that it was over some years ago, and it isn't "saturation" that is the determinant. It is a variety of other things.

There is more than the mere need of getting and holding the business, though that need is a very real one in the light of diminishing income, restricted opportunity and growing competition. For instance, one feature of a properly developed sales relationship are the friendships which may and can be developed as incidental thereto. Certainly the industry needs, as it never nedeed before—friends!

Business friendships are too often deprecated and business friendships between buyer and seller are, in some minds, evaluated in terms of the dollars interchanged. There are few, if any, successful industries in this country today that do not place a definite value beyond dollars on the relationships that have been built and held during the passing years between themselves and those industries or individuals with whom they have buying or selling relationships. Out of such relationships has grown a community of purpose and understanding between buyer and seller which constitutes a very definite element of going value.

Policies and plans for selling power to industry under present conditions are outlined by Mr. Finlay in this article. His long experience with the West Penn and other American Water Works properties gives his views competency. As an executive he has taken great interest in power sales and has applied the policies outlined.

Effective sales ability, which has created in the minds of the customers a sense of value in the service of the seller, also builds in the minds of the public at large, and, in natural sequence, in the minds of politicians or overambitious governmental agencies, a sense of respect for the organization supplying the product, tending to create immunity from unwarranted attack.

Does any power company today buy its machinery from a manufacturer from whom it can secure nothing but the equipment? It does not, or the executive heads of that power company would not last long in office. It buys service supplemented by confidence.

It is just as true—as every man in the power industry knows—that a nation-wide power supply not backed by the characteristics of individual initiative, resourcefulness, inventive genius and enterprise, which have made the industry what it is today, would be a poor and uncertain thing. Certainly we in the industry have failed to get that idea across to the country, or the domestic, or commercial, or even industrial consumers would never be quite so ready as they are to shift from a privately owned source of electrical supply to a municipal plant or a service supplied by some governmental agency, each with its tendency to lag in progressive development and only to thrive by applying to its use the improvements in practice made available by the initiative of private industry. There can be only one reason for this elementary weakness in service supplied by the privately owned power industry, and that is that it has failed to sell itself with its service.

Selling itself cannot be accomplished by a mere advertising of one's virtues. Public relations advertising has its value and its place, but the problem is too deep to cure in such a

superficial fashion. "Selling itself," as applied to any industry, means driving home the fact that the organization back of the service or the product is just as essential as the product. The two can only be viewed as one, and that is not the case today with the power industry.

Many methods available

There have been a variety of attacks made upon this very definite and well-recognized problem. These have ranged from public relations campaigns to extensive advertising programs of all sorts and kinds. All of these have had their value, which value can be real provided the activity is conducted skillfully, openly and on a high plane, but with the objective primarily in mind to serve the ends of a privately owned industry and the service thereof and not merely to sell electricity procurable from any source.

The objective of all of the foregoing is to supply some few reasons why the application of most thoroughly organized sales methods by electric power companies is decidedly in order as the need of the day.

In using the term "organized selling" it is intended to convey the thought of something distinctly superior to the present brand of power business practice. The range of that practice, even among the large power groups and companies, is from the simplest form of contact, reflecting a sense of inability to secure or develop the business, to some fairly well-planned and working organization setups, but casual surveys would indicate that the latter are relatively few and far between.

To reduce these notes from the general to the specific and to comply with the suggestion that has brought about their publication, let us outline something of what is comprehended in the expression "organized selling." Let us begin with the basic index used by any and every successful industry as its master record for supplying complete knowledge of its sales opportunities. This should include every bit of information which might be of value in contacting and serving every customer. Therein should be found a list of the customer's personnel with whom contact is to be made, present sales conditions, potentialities for new business, etc. In other words, there should be a complete record of past, present and future in exact form.

Related to this master index, there should be stepped down the various records of contacts and the information derived therefrom. Master indices should show clearly how often contacts are made, and related indices should supply the balance of the knowledge necessary to indicate the entire program of sales attack and accomplishment.

All such records must be kept constantly alive, open to investigation and the source of information, as well as of inspiration or warning, to the entire selling organization.

The dominant feature of such a master guide should be the influence it brings to maintaining a continuing relationship between seller and buyer. The very form that it takes should serve continually to impress upon the sales organization that the sale is not only to be made, but is to be held.

That "holding" feature of the sales relationship supplies the next and related phase of a completely and thoroughly organized service. Price has too often been the sole criterion of a sale and to which is tied the hope of permanency of relationship. Mere hope is a poor thing, and simply a price in this relationship has too often served as a weak link. Subsidized governmental agencies can make any price. Ambitious engineers employed by an industrial can oftentimes figure a cost which will induce that industrial to spend a large sum of money in building its own power plant.

To meet that sort of direct and indirect competition, back of the price should be developed a knowledge of customer's needs, which of itself creates a sense upon the part of the customer of value, of service responsibility, of expert knowledge, and more, had by the utility as a source of supply and conveyed through its representatives. That feature of organized selling is one which again requires detailed development beyond anything now practiced by the power industry at large, and, in fact, practiced at all, except in a limited number of cases.

On certain occasions, when the thought has been suggested that the utilities should go beyond merely a readiness to serve an industry, except through a somewhat superficial knowledge of its needs and processes, the reaction has been that the investigatory work involved was too costly and that no warrant existed for a sales service of that extent and nature. If that attitude had been had by the automotive industry, the development of that form of transportation would be years behind what it is today.

The power industry has not been hesitant in relatively recent years in building up its residential load by actively going far afield in studying the use and needs of its residential customers. In fact, a strong belief is held by a number of the leading organizations actively selling in that field that, of necessity, they must build up a use appreciation upon the part of the residential customer that even goes beyond the mere selling of appliances.

The same theory, applied to power sales to industrial users, certainly warrants organizing to discover and publicize methods of use of electricity. An organization for that service doesn't mean merely a limited education of some specialists in a sales force. It means a thorough and up-to-the-minute education of every member of the sales force, and that education constantly reinforced by specific data, available in some usable form.

Industrial handbook idea

Sample pages of proposed industrial handbooks are being published in the ELECTRICAL WORLD. These have been drawn from more fully and completely developed handbooks, the product of one organization and which have been copied in whole, or in part, by a number of companies throughout the country and applied to their service. These handbooks, as developed, may have been something beyond what is necessary. The pages in the ELECTRICAL WORLD may be insufficient to serve the purpose. But somewhere between the two should be found a carefully planned mechanism designed properly to serve the purposes of every act of an aggressive industrial sales organization in the power industry. Possibly nothing can be developed which is designed to meet the needs of all, but an average something is far better than nothing, and upon that something a working, serviceable device can readily be built to match almost any specific need.

There is nothing new in the idea. In general, the principle has been applied to other industries. Its specific working use must necessarily fit the specific service. The point at which the argument is aimed is properly completing the program of thoroughly organizing to sell. The general idea would seem, to those who have taken

[*Continued on page 112*]

Year Ends on Rising Trend

DECEMBER operations of the electric light and power industry increased both as to revenue and as to energy output compared with the like month in 1934. The former rose to $173,458,700, a gain of 5.9 per cent, according to preliminary figures announced by the Edison Electric Institute, while production climbed 13 per cent to 8,567,500,000 kw.-hr. The difference in rate of increase of these two quantities is evidence of the continuing shrinkage in the average price of energy.

Revenue 5.9 per Cent Over 1934, Output 13.0 per Cent —Domestic Rate Drops to 5.03 Cents

There is normally a rise in revenue in December over November. In the present instance it amounted to $4,120,000, which is larger than in any of the past seven years. Also, comparing like months in different years, the December revenue was larger than in any other year except 1929 and 1930. It missed the 1929 figure, however, by 2.6 per cent, whereas energy sales were 9 per cent above 1929.

The energy output, both the total and the average daily, was the largest for any month in the history of the industry. About 36 per cent was produced from water power, but the amount of the latter was only slightly greater than in December, 1934, so that virtually the entire increase had to be carried by the fuel-burning plants, their output rising 21 per cent.

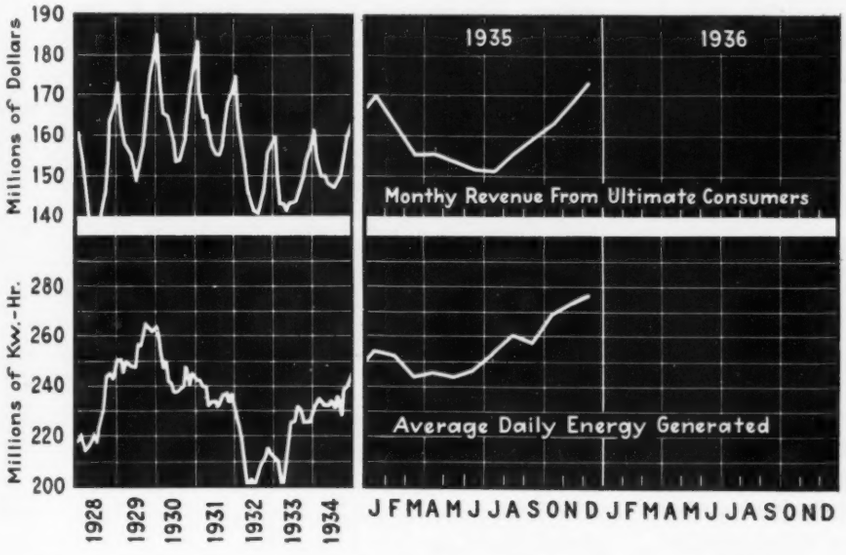


Table I—Monthly Revenue from Ultimate Consumers and Energy Output of Central Stations in the United States

Compared with Corresponding Month of Previous Year

Month 1935	Revenue from Ultimate Consumers†		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
December	173,459	+5.9	8,568	+13.0	3,061	+ 1.0	5,507	+21.0
November	169,339	+5.5	8,207	+14.0	3,055	+ 9.1	5,152	+17.2
October	162,789	+4.5	8,347	+12.5	2,666	+ 4.6	5,681	+17.0
September	159,073	+5.9	7,734	+13.1	2,799	+23.5	4,935	+ 8.2

Table II—Regional Revenue and Energy Output in December, 1935

Compared with Corresponding Month of Previous Year

Geographical Region	Revenue from Ult. Consumers		Energy Generated, Millions of Kw.-Hr.*					
			Total		Hydro		Fuel	
	Thousands of Dollars	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.	Gen.	Per Cent Inc.
United States	173,459	+ 5.9	8,568	+13.0	3,061	+ 1.0	5,507	+21.0
New England	15,230	+ 8.8	596	+10.3	224	—17.8	372	+38.2
Middle Atlantic	50,057	+ 0.9	2,197	+11.6	661	+ 8.8	1,536	+13.2
East No. Central	41,004	+10.9	2,111	+17.5	169	—15.0	1,942	+21.7
West No. Central	14,558	+ 2.0	559	+ 3.3	154	— 7.5	405	+ 8.0
South Atlantic East So. Central	21,778	+ 7.6	1,039 326	+18.6 — 0.7	515 259	—17.7 — 5.6	524 67	+66.1 +23.9
West So. Central	9,159	+ 7.6	398	+11.8	29	+34.5	369	+10.3
Mountain	5,136	+ 6.9	282	+12.3	193	+12.8	89	+11.5
Pacific	16,537	+ 7.3	1,060	+14.4	857	+14.0	203	+17.1

*By courtesy of U. S. Geological Survey, with deductions for operations not regarded as central station.
†Preliminary, Edison Electric Institute.

Year's revenue up 4.6 per cent

With December figures in, 1935 totals are now available subject to minor revisions. Total revenue, according to the Edison Electric Institute, was $1,921,076,800, or 4.6 per cent more than in 1934. Sales to ultimate consumers totaled 77,554,748,000 kw.-hr., up 9.6 per cent. The average annual consumption per domestic customer rose to 673 kw.-hr. from 631 kw.-hr., while the average rate decreased to 5.03 cents from 5.30 cents per kw.-hr. The combined effect was an increase of only 1.1 per cent in the average monthly bill to $2.81.

Regional figures for December show that the maximum increase in revenue, 10.9 per cent, occurred in the East North Central region and the minimum, 0.9 per cent, in the Middle Atlantic. The apparent decrease in output in the East South Central region appears to be due to larger production at Muscle Shoals, which is not regarded as a central station. If this plant is included the region shows an increase of 16 per cent.

Table III—Allocation of Energy December, 1935

Compared with Corresponding Month of Previous Year
(Edison Electric Institute)

Class of Service	Millions of Kw.-Hr	Per Cent Inc.
Total for distribution*	8,521	+13.0
Lost in transmission, etc.	1,492	+ 5.7
Sold to ultimate consumers	7,029	+14.7
Domestic	1,368	+11.8
Com'l, small light and power	1,360	+14.1
Com'l, large light and power	3,493	+17.6
Municipal street lighting	227	+10.4
Railways—street, interurban	439	+ 5.0
Railroads—electrified steam	86	+33.0
Municipal and miscellaneous	56	+ 5.9

*Generated, purchased from other sources, imported, less energy used in railway and other departments.

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Charlotte Ruling a Victory

A VICTORY for the contentions of the utilities was contained in the decision of the U. S. Circuit Court of Appeals at Charlotte in the American States Public Service case. It went to the heart of the entire public utility act. This court went deeply into the constitutional aspects of the case and sustained the lower court rulings that:

1. Congress exceeded its power in barring the use of the mails to holding companies failing to register. Neither the Commerce nor Post Office clause granted this power, in the opinion of the court.

2. Since each subsidiary was doing a wholly intrastate business and no commodity crossed state lines it could not come under federal control, even though owned by a holding company.

This case is analogous to many examples of industry operation and it is estimated that at least 80 per cent of the industry will be free from federal control if this decision is sustained. The court upheld Judge Coleman of the District Court in all claims except his flat declaration that the entire holding company act was unconstitutional.

No stronger statements of the case are needed than the following excerpts from the decision: "The scope of the Public Utility Act is in fact more extensive than any Congressional regulation of the use of the mails or the instrumentalities of interstate commerce which has stood the test of litigation." "The objection to the Public Utility Act is similar to that which proved fatal to the first Child Labor statute passed by Congress and considered by the Supreme Court in Hammer vs. Dagenhart. The statute was held unconstitutional on the broad ground that it was an attempt to regulate the internal affairs of the states." "The application of the Holding Company Act to the business of the debtor and its subsidiaries would bring about a regulation and control of local business in the field in which it relates that would be comparable in its effect to that which the National Industrial Recovery Act of June 16, 1933, sought to impose upon conditions of local trade, and that which the Agricultural Adjustment Act of 1933 sought to impose upon the production of agricultural products."

This decision is a setback for the government and a victory for the utilities. This case is important for, if appealed, it is about the only case that can hope to have the consideration of the Supreme Court at an early date. The difficulty lies in getting the case to the final court, as the report is that government attorneys will block efforts to get it there on a writ. In the meantime this is the most reassuring and significant decision on utility affairs that has yet been handed down.

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Proceed With Caution

SO FAR no one knows how far the government may go into the power business despite the T.V.A. decision. The important point in the T.V.A. decision is an interpretation of its limitations. Congress can build dams to aid navigation and defense and can dispose of the surplus power. Further than this, the court decided that a transmission line to bring the power to a fair market was proper in this instance. This last statement is the only addition to previous rulings and gives the only cause for concern when interpreted as a general policy.

Essentially this project is as yet camouflaged as an aid to navigation, with the production of power as incidental. It is not, like Passamaquoddy, an out-and-out power undertaking. Only on the plea of navigation and defense did the court rule that the Constitutional phrase "or other property" permitted the sale of the Muscle Shoals power. The decision was narrowed to such limits as to permit no interpretation of the broad principles of the T.V.A. project.

Let T.V.A. embark upon manufacturing and sale or invade the rights of private property or of the states and that old Constitutional phrase of "due process" will come into play. Let it attempt unfair competition or confiscation of utility property and an entirely different Constitutional picture is created. Undoubtedly legal authority now exists for the building of many of the government projects based upon the improvement of navigation, but this does not give assurance that this basic intent covers all incursions of the government into private business. Proceed with caution seems to be the best advice to officials of T.V.A. and to others in charge of federal power projects.

Subsidized regional developments, such as the T.V.A., with no cost accounting and with government in business on a large scale, should cause concern to other sections and other industries than the utilities. The Northern industrial states may well measure the effect on themselves of a Tennessee Valley industrial development fostered by the government and bolstered by cheap power supplied through subsidies provided by taxpayers. All industry and all taxpayers should note

the generalized interpretation placed by government ownership advocates on the T.V.A. decision. More court cases and positive action by Congress are both warranted. Uncertainty must be replaced by certainty in both the law and the policy underlying the T.V.A. project as a national undertaking.

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Who Will Sell a Power Plant?

REVIVAL of interest in power station building raises anew the fact that no commercial enterprise is in a position to sell a complete fuel-burning power station. This is contrary to power station economics and to the trend of the times toward factory-built unit assemblies. We don't doubt that more could be saved by changing the commercial set-up to make this possible than in any other aspect of the power situation.

It is dollars cost that counts in power generation. A unit boiler-turbine-auxiliary assembly designed to fit in a minimum space with maximum reliability is a complete job for individual commercial enterprises to undertake to build and to sell. This buying of separate items of apparatus combined with the peculiar and special design ideas of a host of engineers is uneconomical and cannot possibly get the best results. A set of unit plants with standard ratings available from one or more manufacturers who stand back of them is what is needed to reduce power costs and to open the market for fuel-burning stations to overcome the competition of hydro and Diesel plants. The suggestion is logical and can be carried out. A business opportunity beckons.

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Heads Up in Engineering

A REVIVAL of industry expansion and construction spells opportunity for engineers. They find a changed field of practice and a new scope for their activities in the technical industries. Older practices of design detail and concentration on piecemeal construction must be replaced if full value is had from the new engineering work. Unit assembly construction in the factory makes standardization possible and avoids the delays and vexations of installing separate items in the field. The advent of outdoor equipment permits the elimination of buildings and avoids the necessity for large and dangerous power concentrations. Automatic equipment is available that improves upon the older manual operations and permits its omission as a reserve. It is a new day in engineering.

Engineers must look at the new installations as but a part of a complete industrial plant or utility system. It is their job to specify and to locate the new assemblies to the best advantage in an existing installation and to determine the type and rating that will best fit the over-all picture. Dollar engineering is what will count.

Inescapable Facts on Rural Electrification

SEVERAL gems of knowledge will reward those who read the study of farm line construction costs and practices printed in this issue. One is that farm lines are tangible things that must be built of actual materials by human brains and brawn and cannot be wished into existence by the recital of political incantations. Another fact is that farm lines are built at a cost, a cost that must and will be paid, if not by the farmers, then by all who share their substance with the tax gatherer.

Electricity is indeed a desirable addition to farm life. It will save the wages of a hired man by pumping water, milking cows, grinding feed and performing other chores. It will add years to the life of the farmer's wife by lifting from her bowed shoulders a great part of the weight of household labor. It will make the farm home more livable. It will do all this and much more. Every farm in the country should have electric service, and no less achievement than this will satisfy the American ideal. This is great stuff and makes swell headlines for the newspapers and we all cheer for it. But how many of us want to dig down in our jeans for the money necessary for the farmer to enjoy the great boon of electricity? It is to be feared that more than a few are going to point out that such boons as they have personally enjoyed have resulted from their own hard work and they see no reason why they should pay for boons for some one else. The thin edge of irritation in their voices is caused by their realization that they are already contributing quite generously to the farmer's more abundant life through the subsidies of the government.

Another fact is that rural service lines cannot be built to any universal specification. And, aside from the consideration that it would immensely simplify centralized planning, there is no good reason why they should be, and there are many good reasons why not. Climatic and topographic conditions range between wide extremes in this country. Quality of service is an erratically variable concept up and down the land. And what is sufficient and seemly to one man may be grossly inadequate and shoddy to another. These differences, and many others, appear in the design and construction of rural lines and it is useless and unnecessary to attempt to erase them.

The electrification of rural America is a job for business, not for politics, however seductive may be its promises. Farm service holds out very real and very large commercial possibilities to the whole electrical industry. These possibilities can be transformed into solid and worth-while accomplishment by reaction with the enlightened selfishness of good business judgment. It will be a shame indeed if the possibilities of electricity for raising the standards of rural life are perverted and prevented from full realization by forcing them into the devious ways of politics.

Lag Produces Yardsticks

ONE hears a lot about the lag. Sometimes it is the period of time after an economy has cut production cost and before this is reflected in either selling price or wages. That kind of lag helps the balance sheet. If long continued, the technocrats tell us, it spells unemployment. In fact, many blame just that for the 1929 depression.

The other kind is when production costs are suddenly boosted, as by a new tax, and is the period before the old profit ratio can be restored. That kind often spells red ink.

A very considerable portion of those acts of the electric industry which brought its leaders into the limelight as targets for political attack revolve around this idea of the lag. In few industries has there been such an opportunity for cutting costs of production by combination. In fact, the only adequate comparison is to the moving platform, mass production, of the automobile.

Five little electric companies might be barely struggling along, unable to sell some of their larger potential power customers. Merged into one unit, with one power-producing plant, they will be highly prosperous, and will be able to sell those power customers, at a handsome profit, at a rate far below the cost to those customers of producing the power in their own plants.

THEN would come the lag. Profits would be splendid on rates originally charged by the five little struggling companies. So up springs a politician, looking about for some issue on which to get elected, and attacks the electric company, insisting it is robbing the citizens by too high rates. After a while the rates are reduced, but not before the politician has found out attacking the power company had helped his political fortunes, and not before a dozen or so other would-be politicians had noted this easy path to publicity, if not to office.

Of course the electric industry increased its political vulnerability by various other devices. The absentee landlord issue has been easy meat for local politicians since before the Irish question. And Wall Street has been a good political issue certainly since 1896, even if Mark Hanna did beat the man trying to capitalize it that year.

All of which brings up this question of the "yardstick."

Millions of words have been written about the yardstick since the Supreme Court's T.V.A. decision. It can be proved very clearly that the high court eliminated the yardstick. For obviously it would be absurd to contend that "incidental" power, produced by a project constructed for some other purpose, could be regarded as comparable in cost with privately produced power.

But, make no mistake about it, the yardstick is still there.

The yardstick would still be there even if the Circuit Court of Appeals at Charlotte had not sustained the government against the Duke Power Company in the Buzzard Roost, South Carolina, case. It will still be there if the U. S. Supreme Court reverses that ruling. The yardstick will just be a little more prevalent if the high court, as most lawyers in Washington now believe, sustains the Charlotte court's ruling.

For the importance of the yardstick is not on production costs. It is on distribution costs.

AS A MATTER of simple fact, the T.V.A. wholesale rate at the point of generation is not importantly different from the power company's wholesale rate. The big discrepancy comes in between the generator and the customer, not at the generator.

There is nothing new about this, of course. As a matter of fact, it has been overlooked by quite a few amateur critics of the electric industry. But it was important in the presidential campaign of 1928.

In talking of the support of President Roosevelt by Senator Norris of Nebraska, most political writers seem to be laboring under the impression that up to then Norris had been regular in his party ties, if irregular in his actions.

But Norris bolted Hoover in 1928. He supported Al Smith, despite the fact Norris is a vigorous dry and Al Smith was running wet, because the then Governor of New York was in favor of government ownership and development of important power sites.

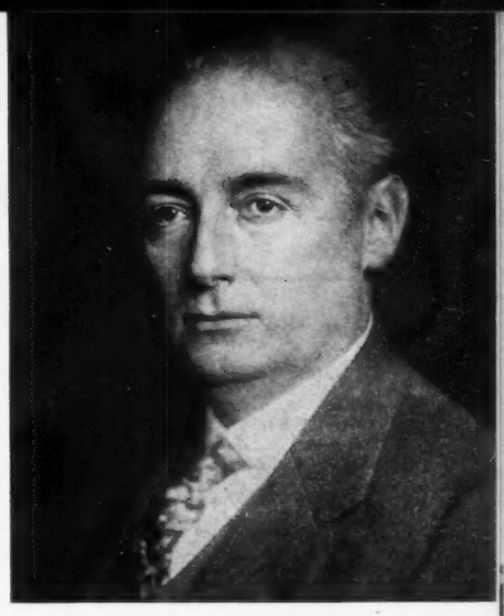
Norris's then colleague, Senator Howell, an ardent government ownership man, gave the writer an interview from his hospital bed in Omaha during that campaign saying Norris was wrong. Howell insisted the importance of cheap distribution far transcended the cost of power production so far as the householder was concerned, but that as far as he was concerned he would rather the government did not spend a lot of money on expensive power developments. The difference between Howell and Norris is that Howell had run the municipal electric plant at Omaha and had learned something about the practical end of the business. Also, of course, Howell was not handicapped in his reasoning by being the daddy of the government spending at Muscle Shoals.

And just to show, incidentally, that even George Norris cannot stop a political tide when it is running in Nebraska, his state that year gave Hoover a plurality of 147,786, some 66,000 more than it had given Coolidge, and nearly 20,000 more than it had given Harding! Though in both of the latter cases Norris was regular!

Which does not mean the Nebraska voters do not warm to Uncle George. They re-elected him quite handsomely two years later. It just tends to prove they do not necessarily follow him!

BUT to get back to this yardstick business. The Supreme Court in its T.V.A. decision left the door wide open, with a big question mark, as to whether it would sanction T.V.A. going into the retail electric business. Or any other kind of business, mentioning steel, but probably thinking of fertilizer. But it gave a clear green light to the selling of power wholesale and building of transmission lines to reach competitive markets.

Tupelo, as a matter of fact, is T.V.A.'s prize exhibit. But T.V.A. is now engaged in negotiations with Memphis, a much more important city, with the idea of hav-



—By CARTER FIELD

This noted journalist gives his personal comments and interpretations on current happenings affecting the electrical industry. His background and his location at Washington make his thoughts informative and interesting even though all may not agree with him.

ing Memphis do what Tupelo has done. The favorite contract T.V.A. makes with a municipal customer fixes a maximum retail rate. And there is the yardstick!

Some power officials are apt to overlook the point that the tremendously important electric rate *politically* is the maximum retail rate—the rate the smallest incomed person who pays an electric bill gets.

And now we get right back to the lag! It has been the contention of many electric company officials that they would be delighted to reduce rates as soon as consumption in any given community had been built up to a point which would make it possible. Of course, meanwhile, the company in question profits greatly by the lag, but there seems to be good logic in the contention.

BUT there is another argument, which is now made, privately, by some of the less fanatical experts of T.V.A., R.E.A., etc. They contend that the power companies, in their argument for building up consumption *before* reducing rates, have the cart before the horse. They insist that drastic rate slashing will be followed by such a boom in consumption that the private companies will actually make more money.

But much more important than that, they will play hob with the Roosevelt-Norris yardstick idea! And by so doing will scotch the nightmare of general government operation of the electric industry. With all its attendant evils of political patronage, Farley "efficiency" standards for merit in choosing and promoting employees, waste and extravagance!

Those making this interesting argument point out that residential consumption in their prize town of Tupelo, Miss., increased from 49 kw.-hr. per customer in January, 1934, to 104 kw.-hr. the following December, or 114 per cent. Commercial consumption increased from 203 kw.-hr. per customer to 359 in the same period, or 77 per cent. Slightly less spectacular increases occurred in Alcorn county and in Athens.

The argument is particularly important because of the probability that the Norris bill, providing for $100,000,000 a year for the next nine years for self-liquidating rural electrification projects, will pass. It is perfectly true that the government will have great difficulty discovering enough projects to spend this amount—always assuming some attention will be paid to the words "self-liquidating"—which in view of many past government experiences might easily prove a violent assumption! But it is also true that if only one-quarter of the money is spent it will still be important.

R.E.A. does not believe in setting up competing generating plants. It concedes that wholesale production is more economical, and is willing to buy from private companies. But there again we get back to the fundamentals. The real profit, and hence the real yardstick, is in distribution!

Many of these rural developments, critics suspect, will turn out to be highly unprofitable. Such cases would lead inevitably to one of two alternatives—direct government operation or subsidy.

In the language of his bill, however, Senator Norris includes the word "generation" as well as "distribution." So the constant threat remains. Incidentally, the Senator thinks little of the Electric Home and Farm Authority. He thinks it is doing virtually nothing. He wants to turn on the heat in a big way. His bill already has the approval of the Senate Agriculture Committee. To vote against it is to be branded as voting against the farmer. Which means that the economy wave now observable in the offing will have to get a lot more menacing to stop it.

In the same connection there is very little comfort for the utilities in the hope that had been so strong that the courts would knock out P.W.A. loans for power projects. The statement in the majority opinion, written by Judge Parker, in the Buzzard Roost case, that the Duke Power Company had not shown possibility of an "irreparable" injury, was startling to some who had studied the case.

UNTIL further developments it points to similar court decisions in all the scores of such projects held up by utility-obtained injunctions.

This is the same Judge Parker, by the way, who was nominated for the Supreme Court by President Hoover, and rejected by the Senate by a vote of 41 to 39.

The fight against him in the Senate was led by Senator Wheeler of Montana, co-author with Rayburn of the public utility holding company bill. Yet Parker joined in Judge Soper's opinion that the Baltimore court had erred in declaring this whole act unconstitutional!

Also against Parker's confirmation in his Senate battle was Senator George Norris and every other Progressive in the upper house.

After Parker's rejection by the Senate President Hoover immediately nominated Owen J. Roberts, against whom no particular opposition developed.

It was Roberts who read the A.A.A. decision of the Supreme Court, which Norris has been deploring ever since as very bad law, but the logic of which is thought by many as threatening the present farm act as well.

So Norris may well wonder if he didn't make a mistake in getting Roberts on the bench instead of Parker!

NEWS OF THE WEEK

Circuit Court of Appeals riddles public utility holding company law, but holds P.W.A. loan and grant for Buzzard Roost power project is legal . . . Mack committee urges eleven changes in New York public service act . . . More utilities announce expansion

Utility Holding Company Act Again Held Unconstitutional

Circuit Court balks at "unconstitutional in its entirety" finding of Judge Coleman, but upholds him on most points — American States Public Service is declared intrastate

"Unconstitutional in its entirety" was too broad a term for the federal Fourth Circuit Court of Appeals as applied to the Public Utility Act of 1935, yet its decision in Charlotte, N. C., a week ago upheld most of the findings of United States District Court Judge William C. Coleman upon which he based that sweeping declaration last November.

This is the utility industry's opinion after scanning the Circuit Court decision in the now famous American States Public Service Company test case; it is the opinion of the Committee of Utility Executives in a release to the press. The decision completely belies early newspaper reports describing the ruling as a New Deal victory.

Friends of court overruled

One of the things which stands out is that the test now is on its way to the Supreme Court; for the second time, the government's lawyers (friends of the court again) were overruled on all their contentions aimed to convince the court that it could not entertain jurisdiction This was regarded as part of the government's strategy to confine the test to the case it has picked — against Electric Bond & Share. But on these points the Circuit Court was positive:

1. The action was not collusive; therefore the court was obliged to decide the question of constitutionality of the act.

2. The trial court was obliged to instruct the American States trustees as to whether or not they should comply with the act.

3. The trial court's ruling that the action was not premature was well founded under the circumstances.

4. The trial court was correct in declaring the company could not reorganize under the terms of the act.

5. The act was designed to impose federal regulation on holding companies and was not, as is contended by government counsel, a bankruptcy measure for which Congress would derive its power from its right to impose uniform bankruptcy laws.

The phases of the holding company law which the Circuit Court swept into the discard were, perhaps, somewhat fewer than those declared invalid by the District Court. On the other hand, in declaring that American States was intrastate even though it is a holding company, and that its subsidiaries are all obviously intrastate—therefore the system is intrastate—the court advanced the point which is being given the most interested consideration by the utility industry. In brief, the court's reasoning was along this line:

American States is intrastate because it does not indulge in interstate commerce, but rather uses simply the instrumentalities of interstate commerce (a statement which would seem on its face to apply to most holding companies, removing them from federal jurisdiction and from the shadow of the dread "death sentence"); operations of American States' subsidiaries are wholly intrastate. Therefore the act is unconstitutional as it applies to this system, as it invades the rights of the states.

Regulatory control described

The court cites the practices which the act of 1935 sets out to correct, then declares: "In the effort to accomplish these purposes, no attempt is made to regulate either the rates or the services of operating companies; and holding company systems, predominantly intrastate in character and within the protective control of a single state, are exempted, section 3(a) (1). The regulatory control of the act is imposed upon holding companies which use the mails or the instrumentalities of interstate commerce for certain purposes."

The decision declares that Congress has the right of police power over movement of goods between states when the goods are harmful; that it may regulate interstate movement of goods not in themselves harmful but being moved for harmful purposes; that it can stop transmission of fraudulent or immoral material in the mails. But as to public utilities:

"It is contended that . . . there is a national police power, which is not limited in its exercise to the transportation of articles in themselves harmful . . . and hence Congress may take steps to eliminate the evils that may reasonably be thought to result from the interstate distribution or acquisition of unapproved securities through interstate communications, or from the unregulated use of the dangerous holding company device.

Congress' power limited

"We are of the opinion that the argument is not in accord with the rule to be deduced from the decisions which hold that the mere use of the instrumentalities of interstate commerce in the transportation of commodities does not authorize Congress to regulate their local production. It should be borne in mind that neither the debtor nor any of its subsidiaries is engaged in interstate commerce. . . . It should be noted also that the act does not merely prohibit the use of the instrumentalities of commerce for fraudulent or unfair purposes, but prohibits activities of the kind already described, whether harmful or not, in so sweeping a fashion as to make it impossible for a holding company covered by the act to carry on its business without registration and without submission to the regulation of the commission in important particulars. . . . *The scope of the Public Utility Act is in fact more extensive than any Congressional regulation of the use of the mails or the instrumentalities of interstate commerce which has stood the test of litigation.*"

The court likens these phases of the act to the unsuccessful efforts to regu-

late child labor, to the NRA and to the A.A.A.

"Confining our attention to the specific question before the court," the decision goes on, "that is, the bearing of the Public Utility Act upon the reorganization proceeding of the debtor, it becomes clear that certain provisions of the act, if given effect, would regulate and control activities of the debtor or trustees necessary to carry out any plan of reorganization, which have no relation to the protection of the mails or the instrumentalities of interstate commerce; and the reorganization of the debtor would be prevented or unwarrantably restricted to a substantial extent . . . No question of fraud or improper use of the mails is involved, since any plan of reorganization must meet with the approval of the District Court and be carried out under its supervision.

"We conclude that the Public Utility Act is invalid in so far as it relates to the reorganization of the debtor, and that the decree of the District Court should be affirmed in so far as the trustees were directed not to register with the Securities and Exchange Commission and the trustees and reorganization managers were directed to continue with the plan for the reorganization of the debtor in accordance with the orders of the court; but that the declaration in the decree that the act is unconstitutional in its entirety should be omitted."

P.W.A. Loan and Gift to County for Power Project Upheld

Judge voices vigorous dissent as majority accepts Ickes claim that Buzzard Roost grant was not made to force lower rates — Duke Power to appeal decision to Supreme Court

The powers of Congress to look out for the general welfare are broad (broad enough to cover a campaign of re-employment); P.W.A. was granted discretionary rights to loan money because Congress could not be expected to approve each individual project; states' rights are not invaded by grants for local projects regulation of which remains with the states; public competition with utilities is legal if the companies have not exclusive franchises; if the P.W.A. administrator swears his intention in making a loan and grant is not aimed to affect power rates the court has no right to question the statement.

Such was the majority holding of Judges John J. Parker and Elliott Northcott in the fourth circuit federal Court of Appeals, Charlotte, N. C., reversing the lower court's finding in favor of Duke Power Company in its fight to block the P.W.A. loan and grant of $2,852,000 (30 per cent gift) to Greenwood County, S. C., for the Buzzard Roost hydro-electric power development.

However, Duke Power lawyers announced at once that they had started work on an appeal; P.W.A. counsel said they would aid in pushing the case up to the Supreme Court for final ruling; Secretary Ickes told the utility to appeal at once or risk charges of dilatory tactics. And the power company had the encouragement of a strongly worded dissent from the majority opinion by Judge Morris A. Soper, who held that the P.W.A. Administrator clearly was attempting to impose a "yardstick" and was outside his power.

The majority opinion found there were three questions to decide: (1) "Is the Act of Congress under which the loan and grant are to be made a valid and constitutional enactment? (2) Will the action of the Administrator of Public Works in making the loan and grant be a valid exercise of power under the act? (3) Are the plaintiffs in position to ask an injunction in any event?"

Then Judges Parker and Northcott set about answering all three questions completely in favor of the government. First of all was the matter of upholding Title II of the National Industrial Recovery Act as dictated by the national emergency and hinging on the "general welfare" power.

Congress' power broad

"There has been much discussion as to the meaning of this 'General Welfare' clause of the Constitution; but it is now definitely settled that the power of Congress to authorize expenditure of public money for public purposes is not limited by the direct grants of legislative power contained in the Constitution . . . If the relief of nationwide unemployment be a legitimate end for Congress to have in view in the exercise of its power to raise and spend money under 'General Welfare' clause, the construction of a nationwide program of public works would seem to be a legitimate means to that end. And we do not think that it can be said that Congress is invading the reserved powers of the states, or is making expenditures for matters essentially local in character, merely because the project for which expenditure is made is not connected with interstate commerce and, when considered alone, is local in character. It cannot be said to invade the reserved powers of a state to make loans or grants of money to municipal cor-

HIGHWAY LIGHTING FOR SAFETY

General Electric

London has no monopoly on pea-soup fogs, as motorists in the Pacific Northwest well know. Hence this installation of sodium lamps on the important highway between Tacoma and Camp Lewis, Wash., largest such illuminating project in the world, which is testing whether this method of illumination is a practical safeguard against fog and other climatic hazards, as well as a general aid to night driving.

porations which the state continues to control, and which are at liberty to reject the loans and grants if they see fit to do so.

"It was out of the question for Congress to prescribe the details of an extended program of public works. It appropriated the money for the purpose, laid down the principles which were to guide the President and the Administrator of Public Works . . . The making of loans and grants in carrying out the policy thus laid down by Congress is the exercise of administrative, not legislative discretion."

The court looked at P.W.A. Administrator Ickes' writings, regarded a P.W.A. publicity item. These, it was granted, seemed to indicate that P.W.A. was interested in a "yardstick." But—

"As the statute is valid, the making of the loan and grant by the administrator is valid if within the terms, notwithstanding the motive of the administrator in making them."

Moreover: "The administrator denies under oath that his policy in making the loans and grants arises out of any purpose to affect rates . . . We feel that we would not be justified in disregarding the sworn testimony of a Cabinet officer . . ."

No invasion of rights

The court points out that P.W.A. could not invade state rights in the guise of guarding the general welfare, "but we do not understand that any such thing is being done here. Greenwood County is but an agency of the state of South Carolina and remains subject to the control of that state in the management of its power project as well as in other matters . . . The administrator's action will not in any sense limit the powers of the state, but will furnish to the state the means of exercising a power which it already possesses, *i.e.*, the power of engaging in a public business for the benefit of its citizens . . . It is an entirely different thing from giving or lending money to private persons for the purpose of defeating a state policy or regulating matters under state control . . . We cannot see that the incidental effect which the construction of the county project may have on plaintiff's rates has any bearing on the question. The business is its business and subject to its control. If a 'yardstick' is established, it is the county's yardstick subject to the control of the state, not of the federal government."

The court held that if there are any damages to Duke Power there is no redress.

"Even if the statute were unconstitutional or the action of the administrator unauthorized, they would not be entitled to the injunction for the reason that no legal right of theirs is infringed by any proposed action of the county or the Commissioner of Public Works . . . The only injury of which plaintiffs can be heard in a judicial tribunal to complain is the invasion of some legal or equitable right. If they assert that the competition of the county will damage them, the answer is that it will not abridge or impair any such right. If they allege that the administrator, in making the loan and grant, is acting beyond the warrant of the law, the answer is that such action does not of itself injuriously affect any of their rights."

Judge Soper, in his dissent, felt no compulsion to believe the sworn statements of Secretary Ickes as contrasted with his published comments. When he made the loan, the Judge declared, "he intended not merely to effectuate the purpose of the act to increase employment quickly, but also to reduce the cost of electric energy to the local community . . . When his authorized publications are considered it is difficult to reach any other conclusion . . . The conclusion is that Title II of the statute is invalid so far as it may be interpreted to authorize the making of such a contract as we have here; and that the action of the administrator herein is beyond the scope of the power which may be conferred by Congress upon an officer of the federal government.

Cut in rates held inevitable

"It is submitted that the state no more than the individual may be induced by gift to break down the barriers which confine the federal government within constitutional limits . . . The reduction of rates under the plan of P.W.A. in this case is not merely probable, it is inevitable. The municipality makes no investment and assumes no liability for the loan, for that is to be represented by revenue bonds payable only out of income of the plant. In addition 30 per cent of the cost of the project is a free gift."

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E. P. Prezzano Heads Westchester Utilities

Election of Edward P. Prezzano to succeed the late Eugene H. Rosenquest as president of the Westchester Lighting Company, the Yonkers Electric Light & Power Company and the Bronx Gas & Electric Company, all affiliates of Consolidated Gas of New York, was announced this week.

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Revenues Increase

Manitoba's publicly owned utilities report revenue of $903,777 for the twelve months ended November 30, a gain of $88,149 over the like 1934 period.

Utilities Reveal Expansion Plans

General Gas & Electric's 1936 outlay put at $15,000,000 — Northern States Power will spend $3,365,000 — Connecticut companies to expand

Utility expansion and improvement, far from having been brought to a standstill by federal activities and recent court decisions, continue to take a prominent place in the day's news. Announcement of a $15,000,000 budget by American Gas & Electric Company was a recent highlight. American Gas' president, George N. Tidd, told of this proposed 1936 expenditure at the annual meeting, adding that no new financing would be involved in the program.

A second substantial item in the expanding fund is the $3,365,000 which Robert F. Pack, president, declares Northern States Power will spend this year in Minnesota, the Dakotas, Wisconsin and Illinois, most of it going for small improvements over this wide area. A larger project, however, is the new substation on Nicollet Avenue in Minneapolis, while an additional line in that city will be run from the Riverside plant to the downtown district. The high-tension line to Long Lake (part of the Twin Cities belt line) will be rebuilt and facilities in St. Paul expanded.

$6,000,000 in Connecticut

A total of between $6,000,000 and $7,000,000 has been rolled up by half a dozen programs announced in Connecticut within the last few days. Connecticut Light & Power has set aside $3,300,000 for an 8,200-kw. turbine at the Stevenson dam, a 25,000-kw. steam turbo-generator at Montville and extension of transmision lines. United Illuminating Company, New Haven, plans to spend $1,000,000 for new equipment in the Steel Point power station at Bridgeport and about as much more for other improvements and expansion. Connecticut Power, Hartford Electric and subsidiaries have appropriated $850,000; Farmington River Power of Poquonock has bought additional land south of the Farmington River for expansion of facilities and expects to raise the dam at this point, and Litchfield Electric Light is spending $37,000, largely on new lines.

Details of Cincinnati Gas & Electric's immediate plans reveal an expansion at the West End station in Cincinnati by the addition of a 36,000-kw. turbine unit, operating at 1,200 lb. pressure, 900 deg. and 3,600 r.p.m. This generator is wound for 13,200 volts and will be hydrogen cooled. It will be supplied with steam by three boilers of 350,000 lb. maximum capacity, burning pulverized coal.

10-Year R.E.A. Bill Under Fire

Committee of Utility Executives holds projects could not be self-liquidating — Cooke announces two loan approvals

Activity continues at Rural Electrification Administration headquarters—two new loans have been announced and practical agreement on nine others—but the rumbling of a rising tide of opposition to the long-range, billion-dollar R.E.A. bills, now pending in Congress, is making itself heard. The leading protest so far on the Norris-Rayburn bill for a 10-year R.E.A. (favorably reported by the Senate Agriculture Committee, ELECTRICAL WORLD, February 22, page 6) has come from the Committee of Utility Executives.

Reed analyzes bill

Analyzing the bill, Hudson W. Reed of United Gas Improvement, on behalf of the committee, attacks particularly sections 7 and 9 covering acquisition and resale of lines in case of default and modification of contracts so as to extend payment dates, waive defaults, etc. Such authority, Mr. Hudson declares, "would enable the Administrator to purchase any or all lines which cannot be placed on a self-liquidating basis. He is further authorized to operate such lines for three years and sell them back at the expiration of this period or any time prior thereto, to any satisfactory buyer—possibly to the original defaulting owners—at any price which he may choose to place upon them.

"He may modify any contract and/or waive the consequences of any default under the contract, within a period of five years on the loans for construction of lines, and two years on the loans for wiring and appliances. This provision will encourage the borrowing of money for lines, wiring, and appliances by persons not financially able to make repayments. . . ."

Commenting on the power to grant loans for generating and distribution plants, running for 40 years, the report declares:

"The building of generating plants for rural service would not only be a duplication of present capacity but would be uneconomical. . . . Distribution lines cannot last 40 years. Lines built under the provision of the bill would completely deteriorate before the expiration of the amortization period. With no depreciation reserve for reconstructing the lines, the customers would be out of service in fifteen to twenty-five years. Severe wind or sleet storms might destroy the lines any time during their normal life. . . ."

The bill came up for debate on Wednesday, but consideration was put off; Democratic Senate leader Joe Robinson said the Administration is for the measure, but wants a reduction in the annual appropriation. The White House may agree to $50,000,000.

New loans approved, according to Morris L. Cooke, administrator, include $232,700 to the Lorain-Medina Rural Electric Co-operative, Wellington, Ohio, for 168 miles of line, and $12,000 for the Rayle Electric Association, Rayle, Ga., for 11.2 miles of line in Wilkes county. The administration, on the other hand, announced that it has not yet approved $365,000 for 320 miles of line to be built by the Eastern Nebraska Public Power District, said in Nebraska reports to have been concluded.

The policy under which R.E.A. announced contracts which it expects to sign shortly reverses the old stand of the administration to refuse any comment until final signing. The eleven projects now in this classification are:

1. Crisp County Farmers Co-operative, Cordele, Ga., $85,000 for 84 miles.
2. Bluffton (Ind.) municipal plant, $17,100 for 15 miles.
3. Meeker Co-operative Light and Power Association, Litchfield, Minn., $450,000 for 420 miles.
4. Lancaster County Rural Public Power District, Lincoln, Neb., $396,000 for 345 miles.
5. Scott County Rural Electric Co-operative, Davenport, Iowa, $260,000 for 265 miles.
6. Tide Water Power Company, Wilmington, N. C., $142,500 for 128 miles.
7. Northwest Rural Electric Company (owned by Montana-Dakota Power Company, Minneapolis) $146,000 for 115.2 miles.
8. Champaign Rural Electric Co-operative, Columbus, Ohio, $595,000 for 440 miles.
9. Plymouth Electric Light Company, Plymouth, Vt., $19,000 for 20 miles of extensions.

Mack Inquiry Offers Eleven-Point Plan

Recommendations made in report to Legislature introduced in Senate — Report condemns holding companies

After twenty-two months of investigation of public utility practices, the Mack utility investigating committee formed in 1934 at the request of Gov. Herbert H. Lehman submitted to the New York Legislature this week its final report, offering eleven recommendations for legislation to correct certain defects in present utility practice. With the presentation of its report the committee, which has spent appropriations totaling $550,000, went out of existence. The legislative program was introduced in the Senate and referred to the public service committee.

The proposed laws would:

(1) Prevent the payment of municipal debts and general expenses out of the profits of municipal public utility operations; (2) require utility companies to furnish to the Public Service Commission verified copies of their tax reports; (3) require the commission to furnish to the State Tax Commission estimates of new reproduction cost, depreciation and present value of utility properties in valuation proceedings; (4) provide that neither the scheduled rates nor the minimum charge for residential customers shall be based in any manner on the number of outlets, number of rooms, cubic or square foot area or other such standards; (5) provide for filing by utilities with the commission of all contracts with affiliated interests for the purchase of electricity or gas; (6) amend the Public Service Law defining the word "corporation" so as to include a trustee or trustees under any trust agreement; (7) require any person or cor-

The Current Drift

Pawtucket Wants T.V.A. Rate

T.V.A. seems to have been getting some publicity, for they've heard about it in Pawtucket, R. I. The city now sets forth that its light bill is higher than T.V.A. "yardstick" rates so it refuses to pay the $5,554 for January to the Blackstone Valley Gas & Electric Company. What parallel the city fathers see between costs of manufacturing and distributing electricity in Rhode Island and in the Tennessee Valley is not made clear, but Pawtucket goes right ahead and cites T.V.A.'s *lowest* rate of 4 mills in contrast with its payment of 5 cents per kilowatt-hour for street lighting.

Insull Companies' Comeback

Another milestone in the comeback of the former Insull companies will be passed shortly. Chairman James Simpson of Public Service of Northern Illinois promises holders of the common stock a dividend, probably a $2 annual basis. Earnings on the shares last year were $3.73, despite largely increased reserves for taxes and depreciation. The company has paid no dividend on the junior shares since the end of 1933—Commonwealth Edison is the only important member of the so-called empire now making payments ($4 annually on the common).

Fine Homes and "Quoddy"

"Quoddy" critics are laying down a barrage on housing expenditures, particularly the cost of $16,667 each, reported for nine homes erected as permanent quarters of operating personnel. The report was demanded after recent stories about the grandfathers' clocks, love seats and Colonial wing chairs for dormitories aroused the ire of Representative R. O. Brewster, Maine Republican.

poration signing or certifying any estimate, appraisal or report to be submitted to the public service corporation to accompany the signature or certification with a statement setting up any present or past interest in the utility; (8) provide that approval by the commission of mergers and consolidations shall not be construed to be a certification that the capitalizations of the merging companies are represented by physical assets commensurate with such capitalizations; (9) give the commission, when asked to approve an issue of utility stock or bonds, the right to make a broad investigation; (10) require gas and electric companies to bill residential customers each month and (11) provide a procedure in the establishment by the commission of temporary rates and permanent rates which will leave no need for courts to intervene with injunctions and restraining orders.

Legislators cleared

The report went into virtually every phase of utility practice in the state, condemning some features and praising others. The committee was vigorous in its condemnation of holding companies and the writing up of book values.

The Mack investigation was originally started to probe connections of legislators with the utilities, and not utility operating practices, but the committee was unable to uncover anything in the way of improper relationships and shifted its function. "Particular attention was given to the relations of the utilities with various political campaigns and of the relations of the officers of the utilities with public officers," the report stated. "Except as above set forth (consulting a utility officer on political matters but not utility matters, and a campaign contribution which was denied) and as a result of the most complete and exhaustive examination, your committee reports that they find no impropriety existing between any member of the State Legislature or any of the public officers and any bankers, brokers or other persons of any character or description interested directly or indirectly in public utility operating or holding companies and any public utility holding or operating companies or their affiliates or any of the officers, managers or employees of any such corporations . . ."

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McNinch Asks Cut in Appliance Costs

Appliance sales ought to be $2,000,000,000 this year, or double the 1935 figure, Frank R. McNinch, chairman of the Federal Power Commission, last week told 1,000 members and guests of the Electric Institute of Washington. Present rate levels constitute sales resistance, in the opinion of the speaker, and a price of $125 for a refrigerator is a challenge to the distributor or contractor because "that size is too big to get in the door of the humble home."

Chairman McNinch was introduced by Potomac Electric's president, William McClellan. "Lower rates," he said, "will come only from loading the distribution system and making it do four to five times as much work." Lighting campaigns were commended but oil burners, ranges, refrigerators and air conditioning loads were among those stressed.

Chairman McNinch apparently did not give full consideration to the fact that Potomac Electric's rate of 3.9 cents is far below the national average, that last year's appliance sales in the District were double the national average, that PEPCO's output has increased steadily for at least ten years, and that there had been an increase in national output of 9 per cent with increase in gross revenue of only 5 per cent.

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New Dam Opposed

Land owners on the Staunton River are continuing their fight against the Smith Mountain dam and power project, carrying their objections in person to the Virginia Corporation Commission in Richmond last week.

COMING MEETINGS

Greater New York Safety Conference—Seventh annual meeting, Hotel Astor, New York, March 3-5.

Edison Electric Institute—Third annual sales conference and sales committee meetings, Edgewater Beach Hotel, Chicago, Ill., March 23-27. Bernard F. Weadock, managing director, 420 Lexington Avenue, New York, N. Y.

Florida Engineering Society — Annual meeting, Daytona Beach, Fla., April 2-4. W. W. Fineren, secretary, University of Florida, Gainesville.

Midwest Power Engineering Conference—Chicago, Ill., April 20-24. G. E. Pfisterer, secretary, 308 West Washington Street, Chicago, Ill.

Association of Iron and Steel Electrical Engineers—Spring engineering conference, Youngstown, Ohio, April 22-23. Brent Wiley, managing director, Empire Building, Pittsburgh, Pa.

Electrochemical Society — Spring meeting, Cincinnati, Ohio, April 23-25. Colin G. Fink, secretary, Columbia University, New York, N. Y.

Missouri Association of Public Utilities—Annual meeting, St. Louis, Mo., April 29-May 1. Jesse Blythe, assistant secretary, Merchants Bank Building, 101 West High Street, Jefferson City, Mo.

Southeastern Electric Exchange—Annual conference, Fort Sumter Hotel, Charleston, S. C., April 30-May 1. J. W. Talley, executive secretary, 308 Haas-Howell Building, Atlanta, Ga.

National Electrical Wholesalers Association—Annual convention, The Homestead, Hot Springs, Va., May 4-9. E. Donald Tolles, managing director, 165 Broadway, New York.

American Institute of Electrical Engineers—North Eastern District meeting, New Haven, Conn., May 6-8; summer convention, Huntington Hotel, Pasadena, Calif., June 22-26. H. H. Henline, national secretary, 33 West 39th Street, New York.

National Electrical Manufacturers Association—Spring meeting, The Homestead, Hot Springs, Va., May 25-28. W. J. Donald, managing director, 155 East 44th Street, New York.

Rural Conference for New England

Rural electrification in many aspects, with demonstrations of equipment and discussions of live problems, will feature a conference at the University of New Hampshire, March 16-18, under the auspices of the Rural Electrification Institute and New England Rural Electrification Committee. To permit full discussion only two or three major talks per session have been planned. On the evening of March 16 there will be a banquet, at which Frank W. Randall, assistant general manager New Hampshire Gas & Electric Company, Portsmouth, will preside. The scheduled speakers at the banquet are Chairman Nelson L. Smith, New Hampshire Public Service Commission; G. M. Putnam, president New Hampshire Farm Bureau Federation; Dr. E. A. White, Chicago, director of the National Committee on Relation of Electricity to Agriculture, and A. R. Schiller, vice-president of the Public Service Company of New Hampshire.

Session program

March 16, Prof. W. T. Ackerman, chairman New Hampshire Rural Electrification Committee, presiding. Greetings from Director J. C. Kendall of the university experiment station; "Improvised Electrical Entrances," L. J. Waldron, New Hampshire Gas & Electric Company; "Advisory Service on Adequate Rural Wiring," F. W. Randall and W. T. Ackerman; "Rural Telephone Service," J. B. Mulrooney, New England Telephone & Telegraph Company. Evening, D. S. Weaver, Department of Agriculture, Washington, D. C., presiding. "Electric Ventilation for Barns," R. C. Proctor, Starline, Inc., Oxford, Mass.; "Apple Storage," Prof. C. I. Gunness, Massachusetts State College, Amherst.

March 17, 9 a.m., Prof. H. E. Pinches, Connecticut State College, presiding. "Sterilizers and Water Heaters for Dairies," Neal D. Herrick, Boston Edison Company; "Feed Processing and Mixing," F. H. Hamlin, Papec Machine Company, Shortsville, N. Y.; 1:15 p.m., Prof. H. N. Stapleton, University of Vermont, presiding. "Electric Brooders," Prof. T. B. Charles, University of New Hampshire; "Poultry Scalding and Wax Picking Equipment," T. B. Charles and N. D. Herrick. Evening, banquet.

March 18, 9 a.m., Prof. C. I. Gunness presiding. "Hotbed and Soil Heating Equipment," G. A. Rietz, General Electric Company; "Co-operative Effort in Rural Electrification," F. L. Rimbach, rural development engineer, New England Power Association, Worcester. Afternoon, inspection of 20,000-kw. floating steam power plant *Jacona* and of Portsmouth Navy Yard.

Advance registrations and reservations may be made through the Agricultural Engineering Department, Durham, N. H.

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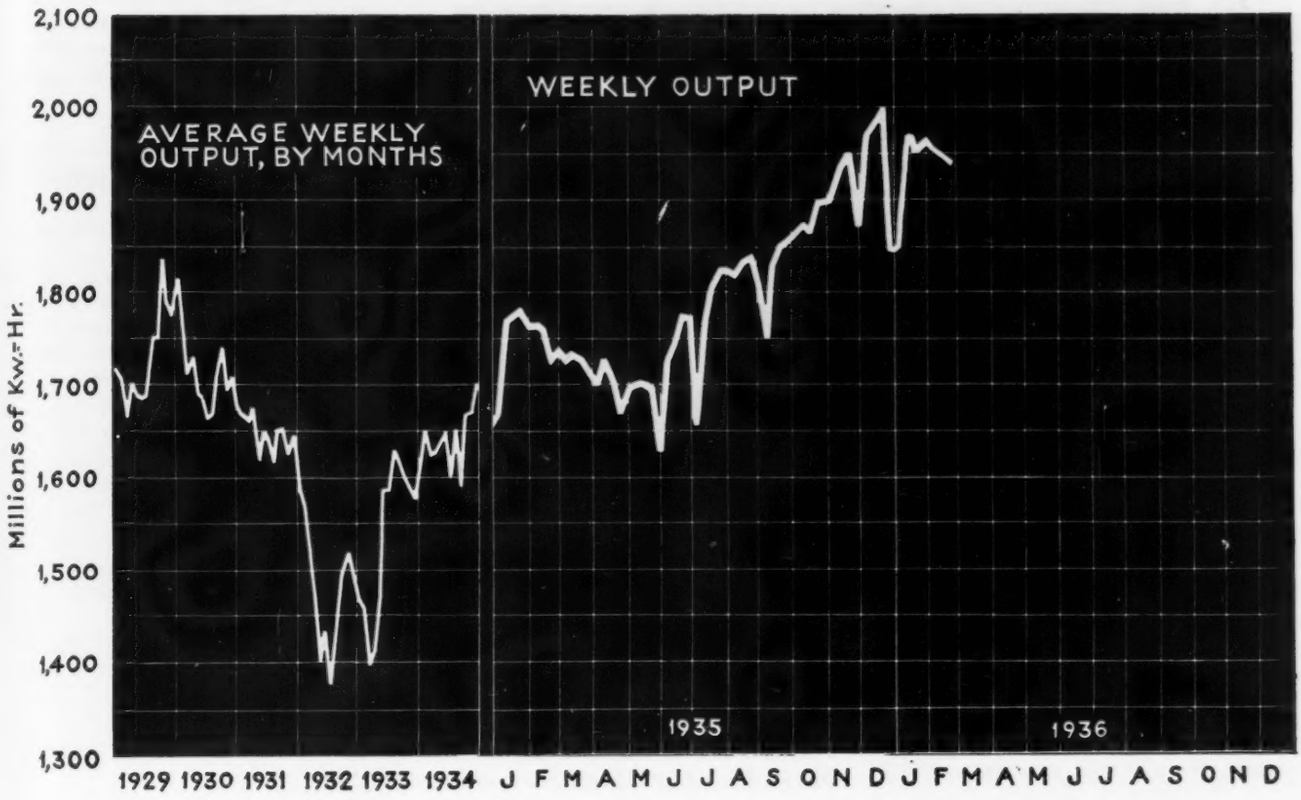
State Electric Club

Leagues in Seattle and Tacoma are planning a joint meeting in the near future to perfect plans for organizing a state-wide electric club.

Output Increases Lead Over Other Years



Further gains in output over previous records for corresponding periods are indicated by the production of 1,941,633,000 kw.-hr. reported by the Edison Electric Institute for the week ended February 22. The excess over the winter of 1929-1930 has been steadily increasing for more than a month. In the middle of January it amounted to 6.3 per cent. Now it is 11.2 per cent, a figure that has been surpassed only once since last June, when the production curve definitely broke through previously established records. Compared with a year ago there was a gain of 12.3 per cent, the largest since the early part of December. As is usual at this season of the year the output is decreasing but the decline is smaller than normal.

Per Cent Change from Previous Year

Region	Week ended Feb. 22	Feb. 15	Feb. 8
New England.....	+ 8.3	+ 6.7	+ 7.4
Middle Atlantic...	+12.5	+10.6	+10.1
Central Industrial.	+10.8	+ 9.7	+10.1
West Central.....	+14.9	+14.6	+12.8
Southern States...	+12.2	+10.8	+11.9
Rocky Mountain..	+24.0	+25.7	+26.7
Pacific Coast.....	+15.8	+13.4	+12.6
United States...	+12.3	+10.8	+10.7

The Rocky Mountain region continues to be far ahead of the rest of the country in its rate of gain over 1935. The Pacific, West Central and Middle Atlantic divisions exceeded the national average—the last-named one for the first time since July. The others all showed increasing gains.

Weekly Output, Millions of Kw.-Hr.

1936	1935	1934
Feb. 22...1,912	Feb. 23...1,728	Feb. 24...1,646
Feb. 15...1,950	Feb. 16...1,761	Feb. 17...1,641
Feb. 8...1,952	Feb. 9...1,764	Feb. 10...1,652
Feb. 1...1,963	Feb. 2...1,763	Feb. 3...1,636
Jan. 25...1,956	Jan. 26...1,782	Jan. 27...1,611
Jan. 18...1,950	Jan. 19...1,778	Jan. 20...1,625

Grange May Bar Seattle Purchase

Seattle's long-standing feud with Puget Sound Power & Light—the city insists on buying all the utility's facilities within its limits plus those in surrounding King County — has encountered opposition from a new and surprising source.

The King County Pomona Grange has voted unanimously to organize its district with a view to confining any purchase to Puget Sound Power & Light facilities within Seattle's boundaries. This would bar nearly half of the contemplated $40,000,000 to $50,000,000 deal.

It was explained, however, that this was not a move to aid the utility company. The grange is fighting to come in for Bonneville-Grand Coulee power; it threatens to condemn the private lines when such energy is available.

•

Power Commission Rejects Delaware River Project

Rejection of an application by the Electric Power Company of New Jersey, Inc., for a preliminary permit for the erection of a hydro-electric project on the Delaware River in Pennsylvania and New Jersey in the vicinity of Tocks Island, Belvidere and Chestnut Hill was announced last week by the Federal Power Commission. H. A. Spalinski of Trenton is president of the company. The proposed project involved the construction of three dams and the installation of a 235,000-hp. plant. At a hearing held last spring in Philadelphia a group of cities and several utility companies opposed the undertaking (ELECTRICAL WORLD, April 27, 1935, page 46).

•

Court Decisions Speed Brazos River Projects

Recent court decisions have accelerated work on the $35,000,000 Brazos River Conservation and Reclamation District project. The immediate factor was the Texas Supreme Court ruling declaring valid the $3,600,000 of bonds which the district issued. A federal fund of $30,000,000 is available for the project, which includes twelve dams and hydro-electric plants on the Brazos River.

Light and Power Stocks Lower

Utility stocks shared in the moderate losses sustained this week by all major groups. "Electrical World" index, 35.8; last week, 36.3.

R.F.C. Owns 5 per Cent of New Middle West

The country's number one bank stockholder, the R.F.C., has fallen heir to a 5 per cent interest in the reorganized Insull top holding company, Middle West Corporation, through liquidation of banks. And the R.F.C. doesn't look too kindly toward the $1,600,000 in fees claimed by various parties to the reorganization.

This all came out when the R.F.C. asked more time to file its exceptions to some of the fees for which court approval has been asked.

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Philadelphia Mayor Sues U.G.I. for $12,741,457

Philadelphia's Mayor S. Davis Wilson made good his threat; he sued United Gas Improvement and Philadelphia Gas Works for $12,741,457 for alleged "gross and culpable mismanagement" of the municipal gas plant. This was the suit U.G.I.'s chief, John E. Zimmermann, had told Mr. Wilson he had better start (after airing the charges) or U.G.I. certainly would take action to clear its name.

•

U. S. Sues Associated in Wilmington Court

Tax liens against Associated Gas & Electric, affiliates, officers and others once connected with the management total about $62,000,000 in the New York courts; now New York's Collector of Internal Revenue, with the apparent intention of making doubly sure of acting in the proper jurisdiction, has entered claims of $54,073,224.15 in federal court in Wilmington. (Associated Gas & Electric Company is incorporated in New York, Associated Gas & Electric Corporation in Delaware.)

•

Higher New York Tax Faces Fight in Courts

New York City's scramble to increase its tax income through higher valuations on public utility properties is in for a fight. This fact became clear when Kings County Lighting Company, at a Public Service Commission hearing on rates last week, announced it would contest the $3,000,000 rise in its assessment; the feeling is general that other utilities will follow suit. Kings County contends the revised real estate assessments were made after the tax rolls were closed.

•

Pacific Gas Plans $90,000,000 Issue

Negotiations for a new issue of about $90,000,000 of Pacific Gas & Electric Company bonds are under way and the filing of a registration with S.E.C. is expected within a fortnight. A group headed by Blyth & Company, Inc., will underwrite the bonds. This will be the largest corporate bond issue ever registered with the S.E.C. under the Securities Act. Proceeds from the sale of this proposed issue will be used to retire two issues of 4½ per cent first and refunding bonds, outstanding to the amount of $84,578,000.

Offering was made on Thursday of the largest new issue of the year at the lowest coupon ever recorded on long-term utility bonds — $55,000,000 New York Edison Company, Inc., first lien and refunding mortgage 3¼s, series D, due in 1956. Interest at 3½ per cent had been contemplated at first, but the steady decline in yields on utility liens over the last year dictated the change, and, equally interesting, the bankers reported excellent demand, the issue being snapped up.

Current Earnings Reports

Operating Companies

	1935	1934
Alabama Power (Year to Dec. 31)		
Gross earnings	$16,794,483	$15,487,516
Net balance	681,232	418,095
Arkansas Pwr. & Lt. (Year ended Nov. 30)		
Gross earnings	7,238,926	7,361,266
Net balance	55,394	258,309*
Carolina Pwr. & Lt. (Year ended Nov. 30)		
Gross earnings	9,901,034	9,658,022
Net balance	320,894	59,104
Consolidated Gas, Elec. Lt. & Pwr., Baltimore (Year ended Dec. 31)		
Gross earnings	30,965,207	28,953,281
Net balance	5,143,440	4,718,392
Consumers Power (Year ended Dec. 31)		
Gross earnings	30,477,295	28,685,138
Net balance	3,785,455	3,022,925
Florida Pwr. & Lt. (Year ended Nov. 30)		
Gross earnings	11,379,929	10,518,440
Net balance	73,478*	871,544*
Georgia Power (Year to Dec. 31)		
Gross earnings	23,698,272	22,122,957
Net balance	1,572,106	947,813
Houston Ltg. & Pwr. (Year ended Nov. 30)		
Gross earnings	8,693,574	8,283,877
Net balance	2,015,596	1,995,303
Montana Power (Year ended Nov. 30)		
Gross earnings	11,249,490	8,765,146
Net balance	1,703,691	213,874
New Orleans Pub. Serv. (Year ended Nov. 30)		
Gross earnings	15,263,706	15,034,115
Net balance	188,448*	193,441*
Ohio Edison (Year ended Dec. 31)		
Gross earnings	15,942,175	15,345,735
Net balance	1,585,169	1,402,953
Pennsylvania Pwr. & Lt. (Year ended Nov. 30)		
Gross earnings	34,587,193	34,052,031
Net balance	4,326,759	5,411,928
Tennessee Elec. Pwr. (Year to Dec. 31)		
Gross earnings	13,409,824	12,409,568
Net balance	505,140	337,370
Texas Pwr. & Lt. (Year ended Nov. 30)		
Gross earnings	8,997,016	9,126,579
Net balance	798,461	966,761
Utah Pwr. & Lt. (Year ended Nov. 30)		
Gross earnings	9,361,353	9,087,472
Net balance	1,154,404*	1,140,959*
Washington Wtr. Pwr. (Year ended Nov. 30)		
Gross earnings	8,513,260	7,697,226
Net balance	1,592,321	1,157,998

Holding Companies

	1935	1934
American Gas & Elec. & subs. (Year to Dec. 31)		
Gross earnings	$71,058,704	$67,547,937
Net balance	8,422,704	7,463,601
Engineers Pub. Serv. & subs. (Year ended Dec. 31)		
Gross earnings	45,861,695	44,580,044
Net balance	717,669*	1,211,667*

*Deficit.

Gross earnings—(Operating Companies) Gross operating revenue. (Holding Companies) Gross operating revenue plus other income. Net balance—Balance available from income for common stock dividends.

MANUFACTURING AND MARKETS

N.E.M.A. Considers Fair Trade Code

Conference to discuss plan approved by Federal Trade Commission — Draft of rules to be submitted to sections and policy committee for acceptance

Electrical manufacturers, looking toward possible adoption of a set of fair trade practice rules, have secured favorable action of the Federal Trade Commission on an application for a conference on the problem, the National Electrical Manufacturers' Association announced this week. It is pointed out that it may prove advisable to draft rules for various sections of the industry and that joining the movement is a matter of individual consent.

The plan now is to prepare a set of trade practice rules which will be submitted to all sections of N.E.M.A. and then approved by the policies division of the association before they are taken up with the F.T.C.

Conferences with the federal authorities, undertaken by representatives of individual N.E.M.A. members independently, have brought back "the very positive statement that they were received in a very helpful and constructive attitude by all of the members of the commission," according to C. L. Peirce, Jr., chairman of N.E.M.A.'s Federal Trade Commission committee.

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General Electric Plans to Appeal Patent Case

An appeal will be taken by General Electric Company from the decision of Judge Alfred C. Coxe in United States District Court in New York in favor of the Electric Machinery Manufacturing Company on its patents on two synchronous motor starting and control systems. Infringement was charged by Electric Machinery; profits estimated at $5,000,000 are claimed to be involved.

•

Frigidaire Develops New Mechanical Unit

A new low for the home refrigeration bill—such is the claim of E. B. Newill, chief engineer and research director of Frigidaire, for the corporation's new "meter-miser" mechanical refrigeration unit. This new unit, which has only three major moving parts, will be incorporated in most of the models marketed this year.

Mr. Newill describes the unit as "unromantic in appearance, looking much like a black derby hat and about the same size." The engineer expects the development to broaden the refrigerator market into lower income brackets.

•

N. Y. Edison Orders New Generator

The largest and one of the first hydrogen-cooled generators to be built has been ordered by the New York Edison Company as part of a new 50,000-kw., 85 per cent power-factor, 13,800-volt, 3,600-r.p.m. Westinghouse superposition turbine generator unit.

The turbine will be a two-cylinder, non-condensing, impulse-reaction unit consisting of a high-pressure element developing 46,710 kw. at 1,200-lb., 900-deg., 200-lb. gage (back pressure). The main unit will be flexibly coupled to a 3,290-kw., feed-heating turbine operating at 200-lb. pressure, 502-deg., 5-lb. gage back pressure at the exhaust, bleeding non-automatically at 60-lb. gage at full load.

•

Electrically Heated Patterns Win Favor

Experience in Cleveland foundries indicates that electrically heated patterns give at least 10 per cent more production and a number of installations have been made. The pattern, being warmed, tends to dry the sand in its proximity to give a more perfect mold, even where the pattern may have deep draws. Some heating jobs have eliminated the need for vibrating the pattern in bringing it from the sand.

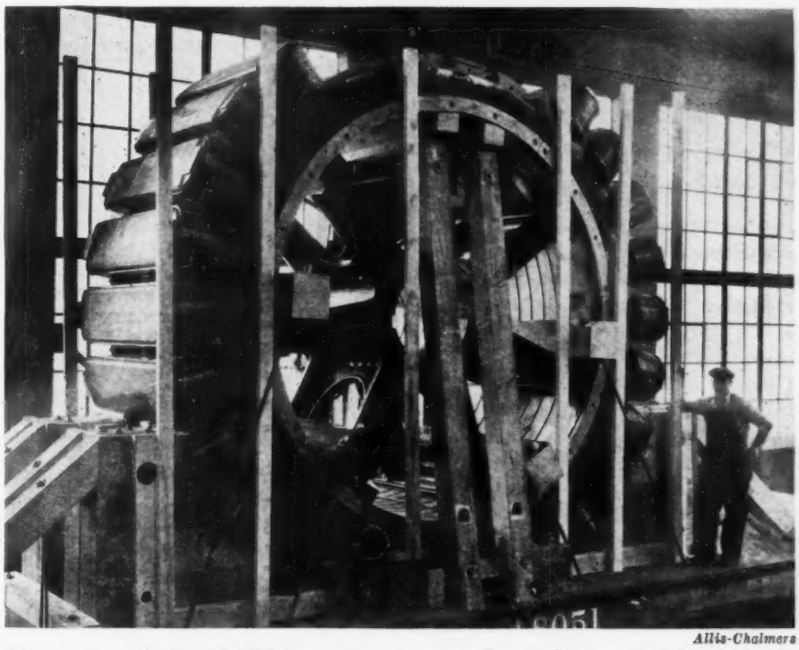
One arrangement involves heaters built into the patterns to avoid damage, either mechanical or abrasive. When a hollow pattern is screwed onto a base plate, the heating element may be between the two or built into the latter.

•

Sodium Lamps Ordered

Sodium-vapor lamps for highway lighting will get their first test in Nebraska on roads leading into Columbus. The City Council has ordered nine lights of 1,000-cp. each, while larger lights also are to be installed on the city's principal streets.

GENERATOR ROTOR FOR BOULDER DAM



Allis-Chalmers

The rotor of the 40,000-kw. generator nearly ready to start its journey from Milwaukee to Boulder Dam. About 280,000 lb. is the weight of this shipment. The rim, to which the rotor coils are keyed, consists of ten rings, each one built up of four sections welded together. The ten rings are clamped together with stud bolts.

Electrical Companies' 1935 Earnings Higher

Widespread improvement in earnings of companies in various electrical lines last year is shown by reports issued in the last few days. Conspicuous is the gain made by General Cable Corporation, which pulled "into the black" to the tune of $33,132 in 1935, as compared with a net loss of $526,078 in 1934.

Cutler-Hammer's net income was $603,386 last year, against $66,464 in 1934, while Electric Controller & Manufacturing reports a profit of $324,926, compared with $178,786. Similar is the showing of Arrow-Hart & Hegeman Electric with net income of $643,555 for 1935, while 1934 earnings were $254,928. Leland Electric replaced 1934's $59,679 net loss with a profit of $24,566.

Leland Electric also announces a new director, Milo B. Scully, field manager for the company, who replaces Raymond T. Brower, resigned. Mr. Scully stepped into the place of Earl B. George as field manager last May when the latter stepped up to the general managership of the Dayton, Ohio, plant.

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Air Conditioning Planned

Air conditioning will play a $12,000 part in the $250,000 expansion program of the Alabama Hosiery Mills, Inc., of Decatur, Ala.

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New Graybar Office

Opening of a distributing house in San Diego, Calif., is announced by Graybar Electric Company. This is the company's 79th branch.

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Ten Electric Kitchens for Cleveland Exposition

Cleveland's live-wire electrical league promises the most complete display of electric kitchens ever shown when the Great Lakes Exposition opens in the Ohio city this summer. Contracts for the space in the Hall of Progress have been signed and detailed plans drawn, according to J. E. North, president of the league.

There will be ten kitchens, complete to the electric clock on the wall and simulated sunlight through the windows. They will range in size from portable summer cottage to mansion varieties.

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Welding Plant Moved

Arc-welding operations of the USL Battery Corporation have been moved from Niagara Falls and will be handled in the future by Owen-Dyneto Corporation, Syracuse, N. Y., another Electric Auto Lite subsidiary.

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Matthews Heads Bureau

C. R. Matthews has been elected president of the Birmingham (Ala.) Electric Refrigeration Bureau and Ed Henley vice-president.

New York Metal Prices

	Feb. 19, 1936 Cents per Pound	Feb. 26, 1936 Cents per Pound
Copper electrolytic	9.25*	9.25*
Lead, Am. S. & R. price	4.50	4.50
Antimony	13.25	13.25
Nickel ingot	35.00	35.00
Zinc spot	5.225	5.275
Tin Straits	47.875	47.625
Aluminum, 99 per cent	19—21	19—21

*Delivered Connecticut Valley.

Field Reports on Business

Reports to ELECTRICAL WORLD *from observers in the field indicate that utility expansion and improvement programs are beginning to come out in some volume, but that the customary spring rise in business has not yet arrived. Encouraging factors include: Higher electric energy and steel output, better retail trade with milder weather. Adverse: The higher copper price is not definite, steel prices are shaky.*

CHICAGO

The decline in business activity which has been under way for more than a month continued during the week, although the recession was small. Retail trade in Chicago improved as higher temperatures prevailed. Wholesale activity increased with the reopening of highways and transportation lines. On the whole, however, the improvement did not come up to expectations.

Construction in this area continues to show vast improvement, with the volume nearly double that of a year ago. Another housing project, calling for the erection of from 50 to 75 residences, will begin within 60 days. The electrical industry notes that practically all the new plans contain a greater number of outlets.

Steady increases in orders are reported by manufacturers of practically all electrical equipment. Small horsepower motors, switches and wiring devices particularly continue to show improvement in sales. Orders for wire and cable are running 15 to 20 per cent ahead of last year.

The long awaited Supreme Court interpretation of the New Deal's T.V.A. has come and gone without any great stir.

NEW YORK

Announcement by several utilities this week of large expansion budgets spread over many sections of the country knocks most of the significance out of court decisions of a more or less adverse character as business factors. The Wilson Dam decision was of strictly local significance; the Appellate Court riddled the holding company law; the decision on P.W.A.'s loan and grant to Buzzard Roost is going on up to the Supreme Court in a hurry.

Major business indexes, however, fail to indicate a real turn for the better. This despite the fact that electric energy output increased its margin of gain over 1935 to 12.3 per cent, against 10.8 the week before. These high marks reflect more the residential than the industrial load. The iron and steel picture is clouded by price uncertainties despite increasing output.

PACIFIC COAST

Statewide rains continue, with imminent danger of serious floods in the Sacramento Valley area, but all doubt as to the prospects for an excellent farming year are removed, with a correspondingly fine electrical business in all branches likely. Residence building is still the outstanding construction feature, averaging about $5,000 per residence, well distributed over all of California. Storms have cut working time, but good orders for all wiring staples are reported everywhere.

Hard plugging of the F.H.A. terms, despite their new feature of a 10 per cent down payment, is keeping sales of major appliances up to their January record, though the best seller, refrigerators, has been somewhat hampered by deliveries.

Sales of 5 to 25-kw. transformers continue fairly strong with Coast plants apparently working to full capacity in an effort to accumulate a reserve stock for the peak demand in a month or so. The San Joaquin Valley, as usual, is the location of greatest call. Irrigation motors are expected to reach a high in about two months. Meanwhile mines are causing a steady demand for heavier machinery, such as an increase of 3,500 hp. in one area on the Mother Lode. Contractors report widespread reconditioning, the average job totaling about $20,000, with the electrical proportion running as high as 30 per cent.

NEW ENGLAND

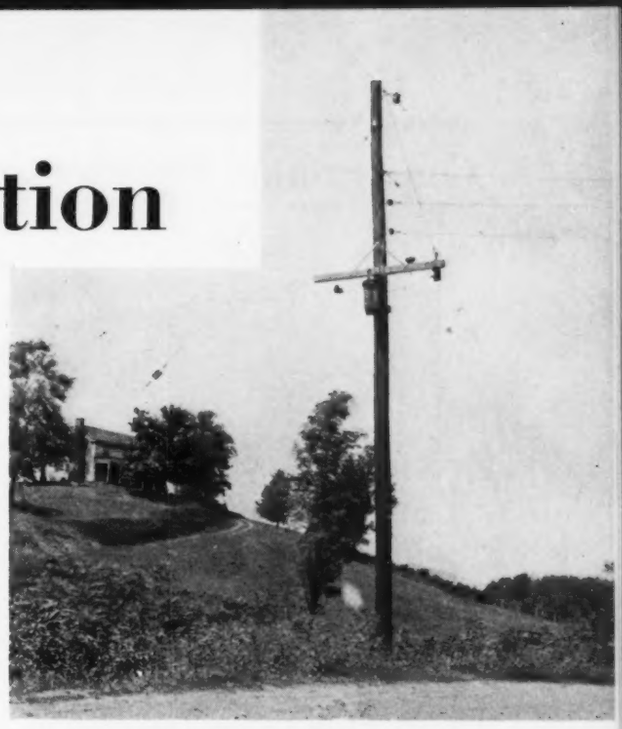
That a definite stride in the direction of more buying of electrical equipment in this district has been taken is indicated both by recent announcements of construction programs by prominent utilities and industries and by the brisk trend in buying. Negotiations are active for power equipment.

Plans for institutional buildings now being prepared in this district presage buying in large volume of electrical equipment for signalling and alarm systems, according to a prominent manufacturer. Small motor sales are steady in single orders; fractional horsepower motors are moving regularly to manufacturers of electrical appliances. Announcement of price cuts ranging from about 10 to 20 per cent list for fractional hp. motors, which took effect February 20, is of interest together with the news that a nationally known manufacturer represented in this district has built a new plant to meet keen competition through mass production with the most modern available equipment.

Electric industrial heating furnace installations are increasing, notably in Rhode Island, where two 18-kw. outfits for annealing brass chains, a 15 kw. unit for brass ring manufacture, and two for annealing gold plate and wire were sold recently.

As might be expected, the Supreme Court decision in connection with the T.V.A. sale of energy from Wilson dam has had no effect on New England utility budgets.

Costs and Construction of Farm Lines



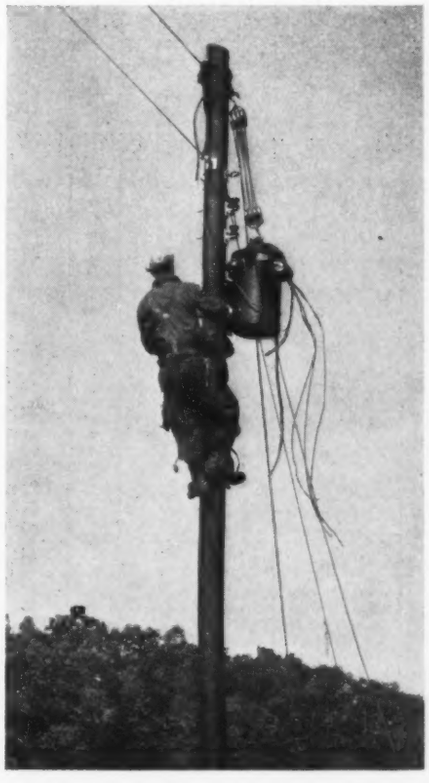
Why farm lines are unprofitable—Not every farmer is a customer—Note that the house on the hill is not connected, although a transformer is installed to serve a house across the road

Facts on Costs of Rural Lines and on Their Construction — Data From 105 Utilities in 37 States on 194 Lines Built and Proposed Are Analyzed to Show Trends of Practice. Particular Discussion on the "Why" of Costs With Comments From the Field

By **FRANK R. INNES**
Western Editor

"RURAL electric service" is not a term of definite meaning. Each man has his own idea of what "rural electric service" is and of what it includes, and he would be hard put to find another man with exactly the same idea. This diversity of conception of a thing that we have come to regard and to speak of as definite is the reason why the data in the accompanying tabulation of rural line construction practices disclose such a wide variability. Study of these data allows no other conclusion than that efforts of government to set up an inflexible rule of stated maximum rates, of stated minimum costs, of 3 per cent interest and of 20-year payoff as a plan for the electrification of rural America must inevitably result in grievous disappointment to those it is intended to benefit and in great monetary and social loss to the nation.

In the accompanying tabulation are listed the rural line construction practices of 105 different utilities in 37 states. These data represent either lines that have been built very recently or projected lines that will be built soon. There is included very little of yesterday's design. What is here is today's practice. These data constitute a presentation which is admittedly deficient from the engineering point of view. But it is the only serious attempt that has yet been made to bring together and to analyze a convincing amount of information on the subject. To that extent, and it is not small, the information presented here is of real value. Also, manufacturers and other suppliers of materials and equipments used in the construction of rural lines should profit from study of the data. But the greatest value, the consideration which, if driven home in the right quarters, will repay many thousandfold the time, labor and money expended on this survey, is the tangible proof it affords that electric service to rural America is a business that must be handled as a business, not as an eleemosynary undertaking by governmental or any other agencies. The engineering and economic aspects of rural service are so many and so diverse as entirely to prevent its development by rigid formula.



The important item of cost

The point of vital concern in this matter of farm service is cost; all other considerations are subsidiary to it, no matter whether they are the benevolent aims of social theorists or the practical affairs of engineers and business men. The present discussion is occupied with only one part of the cost of rural service, that of building the lines. Cost to the customer for wiring, equipment and appliances to make electricity useful to him, which in national total is a staggering sum, does not enter here. Nor does cost of the electricity itself.

Governmental actions and attitudes have stated in more than just inferential terms that complete electrification of our country's farms must be a matter of subsidy. In this connection it should be pointed out—and it should not be forgotten—that the general policy of the electric utilities in farm service extension has always included and does now include a subsidy of no mean proportions. Reference is to the commonly accepted practice of omitting from rural line cost any proportion of the total system investment. All other classes of service bear their

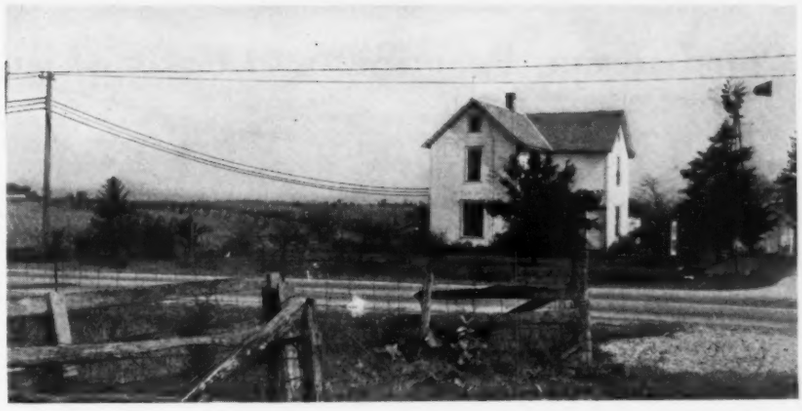
Construction Practices and Costs of Rural Lines

For explanation of column headings and special notes see pp. 69 & 71.

	Design Characteristics															Assumed Factors of Design			Transformers	Estimated Costs per Mile	
	Electrical							Mechanical													
			Grounds							Conductor		Poles									
	Type of System	Neutral	Locations	Max. Resist. Allowed	Lightn'g Arrest.	Ground Tied to Neutral?	Type of Regulator	Ruling Span in Feet	Loading	Kind	Size	Kind	Class	Height	Treatment	Load per Mile	Customers per Mile	Regulation Range %	Minimum Size and Type	Primary Line Only	Complete for Service
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1	2.3D	....	....	25	T	Yes	B	250	C	ACSR	2–4	R Ced	5	30–35	B	.....	3–5	10	3D	$1,200	$1,600
2	6.6D	....	T	15	T	No	BA	175	C	Cop	6	R Ced	6	30	B	.....	3	8	1.5D	623	1,018
3	6.9	....	NoG	rounds	.....	.....	.....	300	C	Cop	6	R Ced	5	35	No	2	2	10	1.5D	320	600
4	6.9	....	NoG	rounds	.....	.....	LA	400	C	CCS	.....	R Ced	6	35	B	7	2	10	3D	900	680
5	6.9	....	NoG	rounds	.....	.....	.....	500	C	CCS	6	R Ced	5	35	B	2	2	10	1.5D	750	1,030
6	11.9Y	S	S	25	A	....	LA	315	C	Cop	4	Pine	7	30	F	36	3	5	3D	699	1,251
7	6.6Y	C	T	25	No	No	No	500	L	CCS	6	Pine	6–7	35	F	3	2	16	3ST	735	800
8	6.6Y	C	T	25	No	No	No	500	L	CCS	6	Pine	6–7	35	F	5	4	16	3D	725	840
9	6.6D	....	.....	.....	T	No	B	350	C	ACSR	4	Pine	5	35	F	10	3	12	3D	500	900
10	2.3Y	S	....	5	A	....	LA	325	C	ACSR	6	Pine and NWC	6–7	30	F	1.5	3	6	1.5D	720	1,330
11	4Y	S	S	.....	A	No	LA	325	C	ACSR	6	NWC	6	30	.....	.....	.....	6	1.5D	.....	.....
12	11.9Y	S	S	25	A	....	BA	265	C	ACSR	4	R Ced	7	30	B	36	3	5	3D	699	1,251
13	4Y	C	T	10	T	Yes	BPA	500	C	ACSR	4	Pine	4–6	30–35	F	6	4	5	1.5D	900	1,150
14	2.3D	....	T	50	T	Yes	PA	450	...	ACSR	4	Pine	7	35	F	5	5	10	3D	600	975
15	7.6D	....	T	50	T	Yes	No	450	...	ACSR	6	Pine	7	35	F	5	5	10	3D	650	1,200
16	13.2D	....	T	25	T	Yes	No	450	...	ACSR	6	Pine	7	35	F	5	5	10	3D	700	1,315
17	4Y	C	T	25	T	Yes	No	450	...	ACSR	6	Pine	7	35	F	5	5	10	3D	600	915
18	2.3Y	C	E	15	T	Yes	LA	250	C	CCS	6	Pine	8	25	F	3	3	4	1ST	450	655
19	2.3Y	S	T	15	T	....	LA	175	C	ACSR	2–4	Pine	6	25	F	5	1.5	10	1D	900	1,200
20	4Y	S	T	25	T	....	PA	325	C	Cop	8	R Ced	6	30	B	20	5	10	1D	1,300	1,800
21	2.3D	....	T	25	T	Yes	.....	350	C	Cop	6	Pine	6	30	F	2	2	10	3D	375	600
22	2.3D	....	T	25	T	Yes	.....	350	C	Cop	4	Pine	6	.....	F	5	4	10	3D	375	725
23	4.6D	....	T	25	T	Yes	.....	350	C	Cop	2	Pine	6	40	F	10	6	10	3D	450	950
24	13.2Y	C	T	.....	T	Yes	BA	600	L	Cop	6	Pine	7	35	F	2	8	20	1ST	*	*
25	6.9D	....	....	5	A	No	LPA	275	C	Cop	4	R Ced	6	30	B	25	4	10	3D	810	1,435
26	6.9D	....	....	5	A	No	LPA	400	L	CCS	6	Pine	7	30	F	15	4	10	3D	700	1,300
27	12.5Y	C	T	5	A	Yes	PA	400	L	ACSR	6	Pine	5	30	F	3	5	10	1ST	700	1,000
28	13.2D	....	T	.....	T	No	B	365	C	Cop	6	Pine	6	30	F	.....	3	10	2.5D	550	1,300
29	12Y	S	T	25	A	No	BA	400	C	Cop	6	R Ced	3	30	B	14	4	10	2.5D	860	1,593
30	2.3Y	C	T	3.5	A	No	BA	400	C	Cop	6	R Ced	5	30	B	14	4	12	1ST	593	851
31	2.3D	....	....	.....	T	No	No	250	L	Cop	6	R Ced	C	30	B	25	4	10	1.5D	947	1,069
32	4Y	S	E	2	A	No	B	480	L	CCS	8	R Ced	....	35	B	3.3	3	12	1.5D	700	972
33	2.4Y	S	S	100	T	Yes	BA	300	L	ACSR	6	Pine	6–7	35	F	3	6	8	1.5D	700	1,100
												R Ced	7		B					1,200	1,800
34	2.3Y	S	E	.....	T	No	LA	375	C	CCS	4	Pine	4	35	F	10	4	6	3D	1,000	1,340
35	2.3Y	C	T	*	T	Yes	LA	175	C	Cop	4	Pine	6	35	ZMA	8	8	10	3D	1,393	2,097
36	4Y	S	S	5	No	No	LA	264	L	Cop	6–4	R Ced	4	35	B	20–50	5	8	3D	1,100	1,600
37	11Y	S	S	5	No	No	BA	264	L	Cop	6–4	R Red	4	35	B	20–50	5	8	2.5D	1,200	1,950
38	4Y	S	S	25	T	No	B	293	C	ACSR	6	R Ced	7	30	B	.....	3	10	1.5D	455	745
39	4Y	S	S	25	T	No	B	293	C	ACSR	6	R Ced	7	30	B	.....	6	10	1.5D	455	1,100
40	4Y	S	S	25	T	No	B	293	C	ACSR	6	R Ced	7	30	B	.....	18	10	3D	455	1,250
41	6.6D	....	....	25	T	No	B	293	C	ACSR	6	R Ced	7	30	B	.....	3	10	3D	455	945
42	6.6D	....	....	25	T	No	B	293	C	ACSR	6	R Ced	7	30	B	.....	6	10	3D	455	1,240
43	6.6D	....	....	25	T	No	B	293	C	ACSR	6	R Ced	7	30	B	.....	18	10	5D	455	1,400
44	13D	....	....	25	T	No	B	293	C	ACSR	6	R Ced	5	35	B	.....	3	10	5D	570	1,140
45	13D	....	....	25	T	No	B	293	C	ACSR	6	R Ced	5	35	B	.....	6	10	5D	570	1,525
46	6.6D	....	T	25	No	....	PLBA	400	C	ACSR	4	R Ced	B	35	AP	7.5	8	10	1.5D	570	1,080
47	2.4D	....	T	25	No	....	PLBA	300	C	Cop	6	R Ced	B	35	AP	7.5	8	10	1.5D	650	1,050
48	2.3Y	S	S	.....	T	No	LA	400	C	CCS	6	R Ced	7–9	30	B	1.5	3	8	1.5D	820	1,220
49	2.3D	....	....	.....	T	....	PA	.....	C	ACSR	4	R Ced	5	35	B	10	10	12	1.5D	1,500	2,100
										Cop							4			800	1,240
50	2.4Y	S	S	2	T	No	B	360	C	CCS	6	Pine	6	30	F	1	3	10	3D	600	888
51	6.9Y	S	S	2	T	No	B	360	C	CCS	6	Pine	6	30	F	1	3	10	3D	600	888
52	4Y	S	S	2	T	No	LA	175	L	Cop	4–2	Pine	4	35	F	20	6	8	3D	1,440	2,300
53	2.3D	....	....	25	T	No	LA	400	C	Cop	6	Pine	7	35	F	1	5	10	1.5D	925	1,400
54	4Y	S	S	5	T	No	LA	400	C	Cop	6	Pine	7	35	F	1	5	10	1.5D	925	1,400
55	12Y	C	T	100	T	Yes	LA	300	C	ACSR	6	Pine	6	30	F	5	4	12	3D	750	1,500
56	4Y	C	T	100	T	Yes	LA	300	C	ACSR	6–4	Pine	4	35	F	5	8	12	3ST	700	1,300
57	2.3D	....	T	25	No	....	LA	450	C	ACSR	4	R Ced	5	35	AP	.....	.....	10	3D	525	.....
58	6.9D	....	T	25	No	....	LA	450	C	ACSR	4	R Ced	5	35	AP	25	4.5	10	3D	550	750
59	11Y	S	T	25	No	No	LA	450	C	ACSR	4	R Ced	5	35	AP	.....	.....	10	3D	560	.....
60	6.9D	....	....	3	T	No	LA	350	C	ACSR	6	R Ced	6	30	B	20	5	10	3D	750	1,400
61	6.9D	....	....	3	T	No	PA	350	C	CCS	6	Pine	6	30	F	20	5	10	3D	750	1,400
62	6.6Y	C	T	15	T	Yes	No	250	L	ACSR	4	R Ced	4	30	B	10	1.3	10	3D	800	1,100
63	6.6D	....	T	15	T	Yes	No	250	L		4	R Ced	4	30	B	10	1.3	10	3D	850	1,145
64	13.2D	....	T	15	T	Yes	No	250	L	Cop	4	R Ced	4	30	B	10	1.3	10	3D	875	1,275
65	2.3D	....	.....	.....	T	Yes	.....	275	C	ACSR	4	Pine	7	30	F	5	4	8	1.5D	775	1,015
66	4Y	S	S	1	T	Yes	.....	275	C	Cop	4	Pine	7	30	F	5	4	8	1.5D	775	1,015
67	4.6D	....	.....	.....	T	Yes	.....	275	C	Cop	4	Pine	7	30	F	5	4	8	1.5D	775	1,025
68	8Y	S	S	1	T	Yes	.....	275	C	Cop	4	Pine	7	30	F	5	4	8	1.5D	775	1,025
69	6.9D	....	....	.....	T	Yes	.....	300	C	ACSR	4	Pine	7	30	F	5	4	8	1.5D	785	1,050
										Cop											
70	12Y	S	S	1	T	Yes	.....	300	C	Cop	4	Pine	7	30	F	5	4	8	1.5D	785	1,050
71	2.4D	....	T	.....	No	Yes	A	300	L	ACSR	3	Pine	9	30	F	.....	.....	.....	1.5D	.....	.....
72	4Y	S	T	.....	No	Yes	A		L	ACSR	3	Pine	9	30	F	.....	.....	.....	1.5D	.....	.....
73	7.2D	....	T	.....	No	Yes	A		L	Cop	6	Pine	9	30	F	.....	.....	.....	1.5D	.....	.....
74	13.8Y	C	T	.....	No	Yes	A	450	L	Cop	6	Pine	9	30	F	.....	.....	.....	1.5D	.....	.....
75	7.6Y	C	T	.....	T	Yes	.....	400	C	CCS	8	R Ced	7	30	.....	.....	.....	.....	1ST	.....	.....
												Pine									
76	D	....	T	.....	No	No	PA	300	C	CCS	6	R Ced	B	35	B	.....	.....	7	1.5D	700	1,100
77	2.2D	....	T	50	T	No	LA	250	C	ACSR	4	Pine	4	30	F	10	10	4	1.5D	1,720	2,060
78	2.2D	....	T	50	T	No	LA	250	C	CCS	4	Pine	4	30	F	5	5	4	1.5D	1,710	1,760

share of this investment and a little more, so that farm service will be free of it. The farm line has charged to it only the investment made in it alone, and to that really substantial degree is already favored by subsidy.

It is impossible to state an inclusive typical rural line cost in any reasonable sense, just as it is impossible to say how much a house costs. Topography, service quality, climate, local habits, the diversities of men's minds and many other factors enter into the construction of electric lines exactly as they do in the building of houses. In the tabulated data there is exhibited a great confusion of costs abounding in instances of apparent contradiction where lines that look the same from the given technical information show great differences in costs. A mile of rural line must be designed, cut, tailored and fitted to its use and users just as a suit of clothes must be for its use and user.



Electrical design characteristics

Column No. 1—*Type of System*—Of the 194 lines in the table there are three (Lines Nos. 3, 4 and 5) which are not designated as to type of system. However, from the fact that "No Grounds" is noted on them it may be inferred that they are delta connected. Counting these, there are 96 delta systems represented in the table; the rest, 98, are Y circuits. This even division indicates that the older delta is yet far from being displaced by the newer revelation. Undoubtedly this condition represents the necessity, or at least the economic advisability, for conforming rural extensions to existing systems, the operating and cost advantages of the Y connection not being fully accepted or their realization not sufficient to outweigh the lesser expense of continuing in conformity with existing systems.

Of the line voltages represented in the tabulation those of the delta circuits can be taken as of the single-phase line extension. This conclusion does not hold in the Y class, since the questionnaire by oversight did not clearly specify that the voltage of the single-phase extension was wanted, and some of the replies stated the phase-to-phase potential. These can be easily recognized, however, and combinations of the stated voltages can readily be made to show the single-phase extension potentials. The 2.3 Y and 4 Y groups go together, as do the 6.6 with the 11 and 12 and the 7.6 with the 13.2. This realignment results in 57 entries of the 2.3-kv. class, 35 of the 6.6 and 6 of the 7.6. Of the delta circuits there are 3.6 in the 2.3-kv. class, 15 in the 4.6, 35 in the 6.9, 2 in the 7.6, 1 in the 11 and 6 in the 13.2. Combining the two types of circuit, the entries group themselves as follows in order of frequency of occurrence:

Approx.		Approx.	
1. 2.3 kv.	93	4. 7.6 kv.	8
2. 6.6 kv.	70	5. 13.2 kv.	6
3. 4.6 kv.	15	6. 11.0 kv.	1

The data presented in the table, extensive as they are, are still not sufficiently inclusive to justify any but the broadest conclusions as to the relative popularities of various voltages among designers of rural lines. It may be said, however, that there are apparently three factors which are determining rural line voltages today. One is the disposition to employ a rural line voltage in the same class as that of the urban system. The advantages of this in standardization of materials and equipment are obvious. Another is the lower cost of lower voltage equipment. The third factor is the flexibility of the Y circuit. It offers two voltages without transformation. Single-phase loads may be served at a lower voltage to realize its economies and at the same time a higher voltage can be used to carry the bulk of the load. In the present data are 57 lines of 4–2.3-kv. Y circuits. These, with the 35 lines of 12–6.6-kv. Y, are the evidence for flexibility. The 36 lines of 2.3 kv. and the 35 of 6.9 kv. delta indicate the inclination to extend rural lines without voltage change from existing systems. And the fact that, out of 194 entries, 177 are of voltages 6.9 or below is ample appreciation of the lower cost of lower voltage equipment.

Column No. 2—*Neutral*—The use of common neutral for primary and secondary is

Explanations of Column Headings and Entries

Column No. 1—Figures show potential in kilovolts and letters the type of system.

Column No. 2—"C" indicates common and "S" separate primary and secondary neutrals.

Column No. 3—"T" indicates grounds at all transformers, "S" at substations only and "E" that grounding practice is variable but considered effective.

Column No. 5—"T" indicates arresters at all transformers, "No" that none are used and "A" that are used where seems advisible.

Column No. 6—Is lightning arrester ground tied solidly to circuit neutral?

Column No. 7—"P," "L" and "B" indicate respectively pole type line and bus regulators with "A" or "M" to show whether automatic or manual, as "PA" for pole type, automatic.

Column No. 9—"C" indicates that line is built for National Safety Code loading and "L" for lighter than Code.

Column No. 10—"ACSR" indicates aluminum conductor steel reinforced; "Cop," all copper conductor; "CCS" copper covered or stranded steel.

Column No. 12—"RCed" indicates Western red cedar, "NWC" Northern white cedar, etc.

Column No. 13—Better poles may be used in difficult places; the figures show A.S.A. classes for normal straight runs.

Column No. 15—"F" indicates full length and "B" butt creosote treatment. "ZMA" means zinc meta-arsenate and "AP" Anaconda Paste.

Column No. 16—The assumed distributed load in kilowatts for which the line was designed.

Column No. 18—Figures show complete range; that is, both above and below normal.

Column No. 19—Figures indicate kva. size and letters "D" and "ST" whether of ordinary distribution type or the newer single high-voltage terminal.

Column No. 20—Estimated cost of primary line only.

Column No. 21—Estimated cost of line complete with customers using service.

Notes:

3. Customer owned line. Cost is for labor to string wire, plus material. No other labor or trucking charge. Transformers and meters owned and installed by power company.

4. Customer owned line built by private contractor. Transformers and meters owned and installed by power company.

5. Power company line. A rebuild job. Transformer and secondary costs not exactly known, but assumed at $280,000 as in other two lines.

6. (6) Ground is tied to neutral at station, but not at customer's transformers. (9) Grade "C" construction. (16) Single-phase distributed load.

10. (1) Single-phase line changed to 4,000 v. Y as shown in line No. 11 when load develops. (18) This regulation range during lighting hours; at other times 20 per cent range is allowed.

12. Notes for line No. 6 apply here.

19 and 20. Data inclosed in braces applies to both lines. (3) Primary neutrals are grounded at substations only. Secondary neutrals are grounded at each transformer and one span away from transformer pole in each direction that secondary wires are run.

24. Costs too variable to quote.

28. (3) Secondary grounds every three spans, at every meter and at every transformer.

32. Costs are for a two-conductor, phase-neutral branch from a four-conductor feeder.

34. (1) Rural extensions may be either 2,400 or 4,150-volt, two-wire lines taken from three-phase suburban circuits.

35. (4) No ground resistance specified. Common primary-secondary neutral assumed to provide adequate grounding.

36-37. (9) For snow territory, ½-in. ice and 6-lb. wind; for all other territory, no ice and 8-lb. wind.

38-45. (11) This is an equivalent size of conductor and is based on two No. 4 ACSR primaries and two No. 2 and one No. 4 ACSR for secondaries. (19) On 4-kv. lines three customers take three 1½-kva. transformers, six take four 1½s and eighteen take four 3s; on 6.6-kv. lines three customers take three 3 kva., six also take three 3s and eighteen take three 5s; on 13-kv. lines three customers take two 5s, as also do six customers. Costs are based on number of customers shown, equally spaced, include one two-wire loop per customer and are figured on single-phase primary and three-wire secondary.

48. (10) Two strands of copper and one of copper-coated steel. Lighter line for $620 primary only and $920 complete to customers' meters.

57-59. (3) Secondary grounds only. On Y systems primary neutral is grounded only at substations.

65-70. (7) Class of regulator varies with local conditions. Costs are for single-phase lines only and include right-of-way and tree trimming.

71-74. (7) All kinds of regulators are used and all are automatic.

76. (16) (17) Line is built if investigation shows it will produce annual revenue one-third of investment in line extension, transformers, services and meters.

Construction Practices and Costs of Rural Lines (Continued)

	Design Characteristics															Assumed Factors of Design			Transformers	Estimated Costs per Mile	
	Electrical							Mechanical													
			Grounds							Conductor		Poles									
	Type of System	Neutral	Locations	Max. Resist. Allowed	Lightn'g Arrest.	Ground Tied to Neutral?	Type of Regulator	Ruling Span in Feet	Loading	Kind	Size	Kind	Class	Height	Treatment	Load per Mile	Customers per Mile	Regulation Range %	Minimum Size and Type	Primary Line Only	Complete for Service
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
79	4.4D	....	T	50	T	No	LA	250	C	ACSR	4	Pine	4	30	F	5	5	6	1.5D	1,540	1,910
80	4.4D	....	T	50	T	No	LA	150	C	CCS	4	Pine	4	35	F	10	10	6	1.5D	1,810	2,200
81	4.4D	....	T	50	T	No	LA	400	C	ACSR	4	Pine	4	35	F	10	10	6	1.5D	1,710	2,190
82	4.4D	....	T	50	T	No	LA	400	C	ACSR	4	Pine	4	35	F	5	5	6	1.5D	1,650	1,940
83	4.4D	....	T	50	T	No	LA	400	C	ACSR	4	Pine	4	30	F	5	5	6	1.5D	1,000	1,300
84	2.3D	....	T	25	A	Yes	.....	300	C	CCS	6	R Ced	7	30	B	4	4	10	3D	850	1,374
85	6.9D	....	T	25	A	Yes	.....	300	C	CCS	6	R Ced	7	30	B	4	4	10	3D	850	1,522
86	2.3Y	C	T	25	A	Yes	.....	300	C	CCS	6	R Ced	7	30	B	4	4	10	3D	835	1,319
87	6.9Y	C	T	25	A	Yes	.....	300	C	CCS	6	R Ced	7	30	B	4	4	10	3D	835	1,439
88	2.3Y	S	S	25	A	Yes	.....	300	C	CCS	6	R Ced	7	30	B	4	4	10	3D	845	1,329
89	6.9Y	S	S	25	A	Yes	.....	300	C	CCS	6	R Ced	7	30	B	4	4	10	3D	845	1,449
90	2.3Y	C	T	25	A	Yes	.....	300	C	CCS	6	R Ced	7	30	B	4	4	10	3D	845	1,329
91	6.9Y	C	T	25	A	Yes	.....	300	C	CCS	6	R Ced	7	30	B	4	4	10	3D	845	1,449
92	6.9D	....	T	.....	A	Yes	P	300	C	ACRS	4	R Ced	6	35	B	.....	.....	.....	3D	725	1,400
93	2.3D	....	T	50	No	No	No	350	C	Cop	6	Fir	.....	35	AP	2.5	4	11	1.5D	446	847
94	2.3D	....	T	50	No	No	No	350	C	Cop	6	Fir	.....	35	AP	2.5	4	11	1.5D	527	928
95	2.3D	....	T	50	A	No	No	350	C	CCS	6	R Ced	C	30	AP	2.5	4	11	1.5D	566	967
96	2.3D	....	T	50	A	No	No	350	C	CCS	6	R Ced	C	30	AP	2.5	4	11	1.5D	633	1,034
97	6.9D	....	T	50	No	No	No	350	C	Cop	6	Fir	.....	35	AP	2.5	4	11	1.5D	459	940
98	6.9D	....	T	50	No	No	No	350	C	Cop	6	Fir	.....	35	AP	2.5	4	11	1.5D	553	1,135
99	6.9D	....	T	50	A	No	No	350	C	CCS	6	R Ced	C	30	AP	2.5	4	11	1.5D	578	1,160
100	6.9D	....	T	50	A	No	No	350	C	CCS	6	R Ced	C	30	AP	2.5	4	11	1.5D	621	1,202
101	4.8D	....	.....	.....	T	No	BA	300	C	Cop	4	R Ced	7	35	B	12	4	8	3D	920	1,410
102	6.6D	....	T	15	T	No	No	400	C	CCS	6	R Ced	5	35	B	.....	3	10	3D	730	1,260
103	2.3D	....	T	11	T	No	P	200	C	ACSR	2	Pine	A	30	F	.....	4	10	3D	556	1,093
104	6.6D	....	T	11	T	No	P	175	C	Cop	6	R Ced	A	30	B	.....	4	10	3D	.....	.....
105	4.6D	....	T	25	T	No	LPA	600	C	ACSR	4	Pine	5	40	F	3	5	10	1.5D	800	1,300
106	4Y	C	T	15	T	Yes	PA	440	C	ACSR	6	Pine	7	30	F	.....	5	10	1ST	500	1,000
107	2.3D	....	T	15	T	Yes	No	440	C	ACSR	6	Pine	7	30	F	.....	5	10	1.5D	500	1,000
108	6.9D	....	T	15	T	No	LA	250	C	ACSR	6	R Ced	D	30	B	4	4	10	1.5D	700	1,300
109	12Y	S	S	5	T	No	B	265	C	ACSR	6	R Ced	7	30	B	5	5	10	1.5D	1,000	1,500
110	12Y	S	S	5	T	No	B	350	C	ACSR	4	R Ced	7	30	B	5	3	10	1.5D	800	1,000
111	6.6D	....	T	25	T	No	B	250	C	ACSR	6	Pine	C	30	F	3	3	10	1.5D	436	1,140
112	2.3D	....	.....	25	A	No	B	300	C	ACSR	4	Pine	6	30	F	5	4	15	3D	700	1,100
113	4Y	C	T	50	No	....	No	450	L	ACSR	4	R Ced	6	35	B	4	4	20	1ST	900	1,300
114	4Y	C	T	50	No	....	No	550	L	CCS	3	R Ced	6	35	B	4	4	20	1ST	800	1,200
115	2.3D	....	....	.....	T	....	PA	250	C	Cop	4	Pine	4	30	F	8	6	7	1.5D	985	1,680
116	2.3Y	C	T	.....	T	No	PA	250	C	Cop	4	Pine	4	30	F	8	6	7	1.5D	935	1,600
117	6.6Y	C	T	.....	T	No	BA	250	C	Cop	4	Pine	4	30	F	8	6	7	3D	1,000	1,861
118	6.6D	....	T	15	T	No	BA	245	C	CCS	6	R Ced	6	30	B	3	2.5	10	1.5D	731	1,300
119	12Y	C	T	7	T	No	No	350	C	CCS	4	Pine	7	30	F	10	3.6	10	1.5D	750	1,150
120	2.3D	....	T	.....	T	....	BA	175	C	Cop	6	R Ced	6	25	B	3	3	10	1.5D	600	850
121	4Y	....	T	.....	T	....	BA	175	C	Cop	6	R Ced	6	25	B	3	3	10	1.5D	600	900
122	6.9Y	S	T	.....	T	No	BA	175	C	Cop	6	R Ced	6	25	B	3	3	10	1.5D	625	950
123	6.9D	....	T	.....	A	Yes	No	350	C	CCS	6	R Ced	7	30	B	.....	3	10	1.5D	820	1,294
124	6.9D	....	T	.....	A	Yes	No	400	C	CCS	8	Pine	7	30	F	.....	3	10	1.5D	651	1,125
125	6.6D	....	T	15	T	Yes	No	352	C	CCS	6	R Ced	6	30	B	7.5	2.5	11	3D	615	1,365
126	4Y	C	T	15	T	Yes	No	252	C	Cop	4	R Ced	6	30	B	7.5	2.5	11	3ST	510	1,164
127	6.9Y	C	T	20	No	....	No	600	C	ACSR	4	Pine	6	35	F	.....	.....	.....	3ST	500	.....
128	2.3D	....	T	10	T	Yes	No	300	C	Cop	4	Pine	7	35	F	7.5	7	15	3D	650	1,000
129	2.3D	....	T	10	T	Yes	No	450	C	ACSR	2	Pine	7	35	F	7.5	7	15	3D	650	1,000
130	4Y	C	T	10	A	Yes	No	450	C	ACSR	2	Pine	7	35	F	7.5	7	15	3ST	750	1,100
131	7.6Y	C	T	10	A	Yes	No	450	C	CCS	4	Pine	7	35	F	7.5	7	15	3ST	800	1,300
132	6.9Y	C	T	15	T	Yes	No	600	L	ACSR	4	Pine	6	35	F	9	3.2	3	3D	635	812
133	4Y	C	T	25	A	Yes	LA	500	C	Cop	6	Pine	6	35	ZMA	.....	5	10	1.5D	.....	.....
134	13Y	C	T	25	A	Yes	No	500	C	Cop	6	Pine	6	35	F	.....	5	10	7.5D	.....	.....
135	4Y	C	T	25	No	Yes	LA	500	C	Cop	6	Pine	6	35	F	.....	39	10	1ST	.....	.....
136	2.3Y	....	T	25	No	Yes	LA	500	C	Cop	6	Pine	6	35	ZMA	.....	4	10	1ST	.....	.....
137	4Y	C	T	25	No	Yes	LA	500	C	Cop	6	Pine	6	35	F	.....	3	10	1ST	.....	.....
138	2.3Y	....	T	25	A	Yes	No	500	C	Cop	6	Pine	6	35	F	.....	6	10	1D	.....	.....
139	4Y	C	T	25	T	Yes	BA	425	C	Cop CCS	6	R Ced Pine	6	30	B F	10	5	14	1ST 3D	664	1,266
140	2.3D	....	T	15	T	Yes	.....	300	C	Cop	4	Pine R Ced	7	35	F	.....	.....	10	1.5D	1,200	1,500
141	12Y	C	T	.....	T	Yes	PA	600	C	ACSR	4	Pine	5	40	B	.....	4	6	1.5D	.....	1,250
142	4.8D	....	T	15	T	Yes	LA*	400*	C	ACSR	4	Pine	7	35	F	5	4.4	9	1.5D	570	1,238
143	2.3D	....	T	25	T	No	L	300	C	ACSR	4	Pine	C	30	F	.....	5	20	3D	604	1,421
144	4Y	S	T	25	T	No	L	300	C	ACSR	4	Pine	C	30	F	.....	.....	20	3D	.....	.....
145	6.6D	....	T	25	T	No	L	300	C	ACSR	4	Pine	C	30	F	.....	5	20	3D	732	1,695
146	11.4Y	S	T	25	T	No	L	300	C	ACSR	4	Pine	C	30	F	.....	.....	20	3D	.....	.....
147	4Y	C	T	25	T	Yes	LA	150	C	Cop	4	R Ced	C	30	.....	10	8	8	1.5D	1,044	1,618
148	4Y	S	S	.....	T	No	PA	300	C	ACSR	2	Pine	5-7	35	F	.....	.....	7	1.5D	1,200	1,500
149	4Y	C	T	5	T	Yes	PA	350	C	ACSR	6	R Ced	7	35	B	2	3	15	1.5D	700	900
150	4Y	C	T	3	T	Yes	PA	350	C	ACSR	6	R Ced	7	35	B	2	4	51	1.5D	700	1,100
151	4Y	C	T	2	T	Yes	PA	400	C	ACSR	4	R Ced	7	35	B	2	4	12	1.5D	715	1,200
152	2.3D	....	T	5	T	Yes	LA	300	C	Cop	6	Pine	5	35	F	2	4	10	1.5D	650	1,160
153	4Y	C	T	3	T	Yes	BA	300	C	ACSR	6	Pine	9	35	F	1.5	3	15	1.5D	600	1,000
154	4Y	C	T	2	T	Yes	PA	350	C	ACSR	4	R Ced	7	35	B	2	4	15	1D	700	1,100
155	4Y	C	T	5	T	Yes	PA	300	C	CCS	6	Pine	9	30	F	2	3	12	1.5D	600	900
156	4Y	C	T	5	T	Yes	LA	350	C	ACSR	4	R Ced	7	35	B	3	4	15	1D	600	1,000

Construction Practices and Costs of Rural Lines (Concluded)

	Design Characteristics															Assumed Factors of Design			Transformers	Estimated Costs per Mile	
	Electrical							Mechanical													
			Grounds							Conductor		Poles									
	Type of System	Neutral	Locations	Max. Resist. Allowed	Lightn'g Arrest.	Ground Tied to Neutral?	Type of Regulator	Ruling Span in Feet	Loading	Kind	Size	Kind	Class	Height	Treatment	Load per Mile	Customers per Mile	Regulation Range %	Minimum Size and Type	Primary Line Only	Complete for Service
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
157	4Y	C	T	2	T	Yes	PA	300	C	ACSR	6	Pnei	9	30	F	2	3	10	1.5D	620	950
158	4Y	C	T	3	T	Yes	BA	350	C	ACSR	6	R Ced	7	35	B	2	4	15	1.5D	700	1,200
159	6.6D	....	T	20	A	No	B	400	C	CCS	4	Pine	B	30	F	10	5	10	3ST	650	1,000
160	4.8D	....	T	.....	T	....	PLA	150	C	Cop	4	R Ced Pine	4 5	35	B F	.....	.....	7	3D	.....	.....
161	4Y	S	E	25	T	No	LA	175	C	Cop	4	R Ced	C-D	30	B	2	4	10	1.5D	950	1,250
162	6.9D	....	T	.....	T	Yes	No	200	C	Cop	4	Pine	5	30	F	10	3-4	10	1.5D	800	1,200
163	4Y	C	E	25	T	Yes	BA	300	C	CCS	6	R Ced R Ced	6 7	35 30	B B	1	3	10	3D 1.5D	800	1,100
164	4.6D	....	....	.....	A	No	No	150	C	Cop	6	R Ced	7	35	B	.....	8	10	3D	1,244	2,098
165	4.6D	....	....	.....	T	No	LA	280	L	Cop	4	Pine	6	35	F	10	4	12	3D	1,418	1,946
166	4Y	....	....	.....	T	No	LA	280	L	Cop	4	Pine	6	35	F	10	4	12	3D	1,418	1,946
167	2.3Y	C	T	.....	T	Yes	LA	280	L	Cop	4	Pine	6	35	F	10	4	12	3D	1,268	1,796
168	2.3D	....	....	.....	No	....	.....	400	C	ACSR	6	Fir	7	40	AP	10	4	20	1.5D	675	976
169	6.6Y	S	E	.....	No	....	.....	400	C	ACSR	6	Fir	7	40	AP	10	4	20	1.5D	725	1,200
170	11D	....	....	.....	No	....	.....	400	C	ACSR	6	Fir	7	40	AP	10	4	20	2.5D	725	1,433
171	2.3D	....	T	25	T	Yes	No	500	L	CCS	4	Pine	5	35	F	5	3	15	1.5D	575	850
172	4Y	C	T*	5	T	Yes	No	500	L	CCS	4	Pine	5	35	F	5	3	15	3ST	550	775
173	4.6D	....	E	70	A	No	PA	250	L	ACSR	4	NWC	B	30	No	5	9	10	1.5D	800	1,200
174	4Y	S	E	20	T	No	BA	250	C	ACSR	4	Pine	5	30	F	.....	4	10	1.5D	1,340	1,740
175	2.3D	....	T	15	A	No	BA	300	L	Cop	6	Pine	D	30	F	2	4	10	3D	600	900
176	4Y	S	T	15	A	No	BA	300	L	Cop	6	Pine	D	30	F	2	4	10	3D	630	900
177	6.6D	....	T	15	A	No	BA	300	L	Cop	6	Pine	D	30	F	2	4	10	3D	650	1,000
178	11Y	S	T	15	A	No	BA	300	L	Cop	6	Pine	D	30	F	2	4	10	2.5D	650	1,000
179	13.2D	....	T	15	A	No	BA	300	L	Cop	6	Pine	D	30	F	2	4	10	2.5D	700	1,080
180	2.3Y	C	T	.....	A	Yes	B	330	L	CCS	6	Pine	9	30	F	.....	.....	.....	1ST	.....	.....
181	11Y	C	T	25	T	Yes	.....	450	C	ACSR	6	Pine	7	35	F	4	4	9	2.5	708	1,523
182	6.9Y	C	T	25	T	Yes	.....	450	C	ACSR	6	Pine	7	35	F	4	4	9	3	708	1,280
183	2.3D	....	T	25	T	Yes	.....	450	C	ACSR	6	Pine	7	35	F	4	4	9	3	727	1,175
184	12.5Y	C	T	10	A	Yes	PA	400 500	C	ACSR CCS	6	Pine	3 6	30	F	10	7.5	15	1ST	460	1,050
185	6.6D	....	T	20	A	No	B	400	C	CCS	4	Pine	B	30	F	5	5	20	3ST	500	875
186	11Y	S	S	25	T	No	No	450	C	ACSR	4	Pine	6-7	35	F	10	4	10	2.5D	1,000	1,775
187	6.9Y	C	T*	10	No	Yes	BA	450	C	CCS ACSR	6	Pine	5-6	35	F	.....	.....	18	3ST	650	900
188	12.5Y	C	T	5	A	Yes	PA	400	L	ACSR	6	Pine	5	30	F	3	5	10	1ST	700	1,000
189	11Y	C	T	5	A	No	BA	300	L	Cop	4	Pine	6	30	F	3	6	20	2.5ST	500	800
190	2.3D	....	T	5	A	N	BA	300	L	Cop	6	Pine	6	30	F	3	6	20	3D	550	850
191	2.3D	....	T	.....	A	Yes	PA	375	C	ACSR	4	Ches	6	40	ZMA	.....	4	5	1.5D	925	1,365
192	12Y	C	T	25	T	Yes	No	300	C	Cop	4	Pine	7	30	F	3.5	4	10	1.5ST	800	1,300
193	4Y	C	T	25	A	No	.....	400	C	CCS	4	Pine	5-6	30	F	2	6	14	3ST	700	1,000
194	6.6Y	C	T	5	A	Yes	BA	500	L	CCS	6	Pine	8	35	F	2	5	10	1.5D	800	1,400

Notes:

93-100. (1) Of the series of lines 93 to 100 inclusive the odd numbered refer to easy construction conditions and the even to difficult.

109-110. (1) Four-wire, three-phase, 12/6.9-kv. system. Costs are for 6.9-kv., single-phase branch from three-phase trunk.

133-138. (21) These lines built of salvaged and non-standard materials, therefore costs are almost impossible of determination; that is, on any firmly comparative base.

142. (3) Grounds also at customer entrances. (7) If needed automatic pole type regulators are also installed. (8) Also some lines with 300-ft. ruling span and No. 4 ACSR. (10) Copper conductor used for secondaries and services.

171-172. (3) Additional grounds every fifth pole.

181-183. (7) Regulators not normally used, but pole type where required. (20) Type of transformer not standardized; use all kinds.

184. (3) Grounds at every pole.

191. (1) Company builds rural lines also for 4 kv. Y, 46 and 11 kv. delta and 11 kv. Y. (2) Neutrals are common in Y circuits. (12) Chestnut. Lines at higher voltages are of pine with full treatment of creosote.

indicated in 59 of the 98 Y systems; only 39 have separate neutral conductors. The trend that is shown here toward the practical application of the theoretic condition is quite evident.

Column No. 3—*Location of Grounds*—In asking information on this point no distinction was made between primary and secondary grounds. The distinction does not apply to a delta system, and if a Y system with common neutral is used the same grounds are on both primary and secondary. The data on separate neutral Y systems lose much of their apparent ambiguity when associated information in neighboring columns is considered. Of 169 entries in this column, 134 are of grounds at transformers, 27 of grounds at station only and eight of grounds not specifically located but made in number and location considered effective. To the great preponderance of replies stating grounds at transformers must be added evidence from the notes accompanying the table. These say, "grounds every three spans and at every meter as well as at transformers," "grounds at every pole," etc. The data indicate very clearly that grounding as a protective means is getting off to a much better start in rural service than it did in urban.

Column No. 4—*Maximum Ground Resistance Allowed*—Of the 150 entries in this column, the largest single group is 25 ohms with 59. Next comes 15 ohms with 21 entries, 50 ohms with 19 and then 5 ohms with 18. Below 5 ohms are only 15 entries and above 50 are only 4. Thus 118 of the 150 entries lie in the range from 5 to 50 ohms inclusive, with half of the number at the middle of the range. Apparently a maximum allowable ground resistance of 25 ohms can be taken as average practice.

Column No. 5—*Lightning Arresters*—Nearly two-thirds (115) of the 191 entries in this column state that lightning arresters are installed at all transformers, while in 48 cases they are used not at all transformers, but only where it seems advisable. In 28 instances no arresters are used at all. There is much room for differences of opinion as regards lightning protection on rural lines, depending on individual conceptions of service quality and on frequency of lightning storm occurrences in particular regions. It seems improbable that practice in this respect will ever be other than empiric, but it does appear from data that the greater importance of lightning as a trouble maker on rural than on urban lines is being quite generally recognized.

Column No. 6—*Lightning Arrester Ground Tied to Neutral*—Opinion seems to be evenly divided on this matter. In half of the 191 entries it is stated that the lightning arrester ground is tied solidly to the neutral and in half it is stated it is not. In the latter group are included an indeterminate number of cases in which gaps are used. It is probably to be expected, as is the case, that a majority of the entries (55) state solid ground ties to neutral are of Y circuits, while a majority of those (51) state no such ties are of delta circuits.

Column No. 7—*Regulator*—Of the 161 unequivocal entries (those not qualified by notes) in this column, 40 state that no regulators are used. The next largest group (38) indicates the practice of using automatic line regulators in the substation, and to this group might be added four entries of line regulation in the substation without specifying automatic or manual. Dependence on automatic bus regulation is next with 27 entries, and joining this group are 21 that state bus regulation may be either automatic or manual. The automatic pole type regulator is represented with 21 entries, and three more that may be either automatic or manual might be added. Four entries state the use of both line and pole type automatic regulators, one indicates bus and pole type automatic and two show the employment of automatic regulators of all three types, bus, line and pole. From these data it appears that unregulated rural lines are not uncommon, that bus regulation is still strongly in the picture, that line regulation in the substation plays a large part and that, probably, the fairly large number of pole type regulators represented indicates a growing use of these devices.

Mechanical design characteristics

Column No. 8—*Ruling Span*—In the 192 entries in this column 27 different ruling span lengths are found, ranging from 150 to 600 ft. This diversity of opinion is more apparent than real, because many of the differences are of the order of that between 293 and 300. Yet, discounting these small differences, there still remains a sufficient diversity to indicate the need for a meeting of engineering minds on this fundamental factor in line design. The data are grouped as follows for convenience of examination:

1. Spans of 250 ft. and less	33
2. Spans of 300 ft. and down to 250	60
3. Spans of 400 ft. and down to 300	58
4. Spans of 500 ft. and down to 400	35
5. Spans of 600 ft. and down to 500	6

The point of argument seems to lie at the 300-ft. span length, for there are about as many entries of 300 ft. and below as there are above that figure. Nearly two-thirds of the total number of entries are contained in groups 2 and 3. This fact, with the 33 entries of group 1 and the 34 of group 4, may perhaps be taken to indicate that there is a healthy movement toward the use of very long spans and a just as healthy resistance to that movement, with the common practice midway between.

Column No. 9—*Loading*—The purpose of the question whose replies appear in this column was to discover whether or not any substantial revolt has followed certain mutterings that have been heard in engineering meetings in the past several years. Every once in a while some one gets on his feet and points out, as if it were an original discovery, how much money is wasted by that multiplication of safety factors which appears always when engineering practice becomes conventionalized or is reduced to a code. Particularly is it true that you cannot kick any overhead line designer on the shin without eliciting a scream of anguish from a man who is sure that he can stick up a lighter line that will be more than adequate for rural service and a lot less costly than a Code-built structure. Apparently the revolutionary party is gaining adherents, because out of the 190 entries in this column, 37 confess lighter than Code construction.

Column No. 10—*Kind of Conductor*—ACSR leads in this column with 82 of the 200 entries. It is closely followed by copper with 68 and copper-coated steel with 50. Some relationship discoverable from the table might be expected to exist between length of ruling span and kind of conductor. A glance back at column No. 8 does indeed discover such a relationship, but only the very obvious one that copper is very infrequently, if ever, used on extremely long spans. The data do not ap-

Trends in Rural Lines

Designers are striving for lower costs of line construction and are accomplishing much, but no disposition toward cheapness as the sole objective is observable. Engineering ideals of service and strength are not abandoned.

The Y system is better adapted to rural service and the future will probably show rapidly growing use of it. But the delta system is still importantly in the picture, its persistence resting on a solid foundation of conformity with existing urban systems.

Apparently the idea is fading that rural distribution requires high voltages. The lower cost of lower voltage equipment is the deciding factor.

Use of common neutral for primary and secondary on Y systems is a growing practice.

Grounding at all transformers is becoming the rule, as is also the installation of lightning arresters at the same points.

Most rural lines are regulated and the use of pole type regulators is increasing.

That a rural line span should be longer than an urban is agreed, but how much longer is still a matter for argument.

The idea is making headway that an adequate rural line can be built lighter than Code requirements.

Conductors other than the conventional copper and aluminum are already well established in the field with about one-quarter of the entries stating them.

As did urban distribution many years ago, rural line construction is getting started with light primaries.

Engineers still demand pretty good poles for farm service.

No trend toward fence posts, 30- and 35-ft. poles predominate.

No one yet is sure what the load on a farm line will be.

Apparently farm line extensions are not economically justified for fewer than three customers per mile.

The single primary bushing type of transformer is making good progress, but there are still many thousands of small transformers removed and to be removed from urban distribution that will find another lease of life on rural lines.

pear to justify any conclusions at all regarding the use of special conductor types.

Column No. 11—*Size of Conductor*—In this column of conductor sizes (copper or copper equivalent) of 201 entries, practically all are No. 4 (80) and No. 6 (105). The remaining group of sixteen is made up of 8 No. 2, three No. 3, four No. 8 and one No. 12. These latter sizes may be dropped from consideration. As between the No. 4 and No. 6, it can hardly be concluded from the data that the one or the other preponderates in the field. This is to say that although the present data show a difference between the two, the difference is not really large enough to be conclusive. However, by adding to this inconclusive evidence today's heavy pressure for reduction in rural line costs, perhaps it may be said that No. 6 is the more widely used, or, anyway, will be if those of us who own copper mine stocks get our wish for higher copper prices.

Column No. 12—*Kinds of Poles*—Supported as it is by general knowledge of the field, it seems that the difference between the 77 red cedar entries and the 112 pine in this column is sufficient to warrant the conclusion that the trend is to pine. The other woods (Northern white cedar 2, fir 7 and chestnut 1) do not figure importantly in the national picture. Ten companies represented in the data use both pine and red cedar for the building of their rural lines.

Column No. 13—*Classes of Poles*—Some of the replies on this point are in the old letter classifications and others are given in top diameters. Because of the impossibility of direct translation of these designations into the ASA numbered classification, these entries are dropped out of the present analysis, leaving 154 entries to be considered. Of these 60 show class 7 poles, 42 class 6, 21 class 4, nineteen class 5, nine class 9, two class 8 and one class 3. The preponderance (102) of poles in classes 6 and 7 indicates that there is no trend toward the use of excessively light poles for rural line construction.

Column No. 14—*Heights of Poles*—Of the 199 entries in this column, there are 104 of 30-ft. poles, 83 of 35-ft., seven of 40-ft. and five of 25-ft. Here again the difference between the two largest groups does not seem sufficient to warrant any conclusion. Without counting, but from glancing back at column No. 12, there does not appear to be any reason to believe that either size is more or less favored in pine or cedar.

Column No. 15—*Treatments of Poles*—As regards treatment, practice is closely related to kind of pole. Practically all the pine poles are full length treated with creosote, while the red cedar poles are given butt treatment only. Zinc meta-arsenate treatment is stated in four entries and "Anaconda Paste" in sixteen.

Factors of design

Column No. 16—*Load per Mile*—The information in this column has no evidential value as regards a trend in rural line practice, but it is extremely interesting as it exhibits the wide variation of ideas of designers on what farm loads are, or, perhaps, to state it more accurately, ideas on what farm loads will be. Undoubtedly many, if not all, of the load per mile figures here presented are based on local experience and investigation. Undoubtedly, also, it is true in many, if not all, cases that the result derived from experience and investigation is very considerably modified by the individual designer's enthusiasm for farm service, or by his lack thereof. In the 148 entries in this column there are stated 22 different values of load per mile of line, ranging from one to 50 kw. The most popular figure is 5 kw., which appears 27 times, then comes

10 kw. 23 times and 2 kw. 20 times, with 3 kw. and 4 kw. tied for fourth place with fourteen times. Fifth place is contested by 2½ kw. and 7½ kw., each with eight entries. Looking ahead to column 17 for a moment one sees the extremes of 36 kw. for three customers per mile and 50 for five as against 2 kw. to be divided up among eight users and 1 kw. to be shared by five. It is patent that these extremes have their origins in widely different local conditions, but one cannot escape the thought that if the engineers who made these estimates were shifted about the extremes would thus be brought closer together. The average of the 148 entries is 7.12 kw. per mile. Dropping out the top figures of 50 and 36 kw. makes the average 6.12 kw. per mile.

Column No. 17—*Customers per Mile*—These data indicate quite clearly that sharp figuring on construction and operation costs, entire omission of proportionate system costs and hard work in load development—all of which have always characterized private utility efforts to extend rural service—are not sufficient to justify the building of farm lines for fewer than three customers per mile. To bring electricity to the millions of farms in sparsely populated areas must require subsidy, pure and unalloyed.

In this column of 181 entries, 69 are for four customers per mile. In second place come 32 entries of three customers per mile. Next comes five customers with 30 entries. The drop now is sharp with thirteen entries of six customers. The remaining entries divide into three parts, one of twelve entries with customer occurrence ranging from 1.3 to 2.5 per mile, another of 21 entries of 7 to 30 customers per mile and a median group of four entries of 3.2, 3.6, 4.4 and 4.5 customers per mile. The average of the column is 4.64 customers per mile.

Because it is an especially significant figure at the present time, it seems worth while to make the more refined analysis of the data on number of customers per mile; that is, to consider the data, not as separate entries in the table, but as of the number of companies supplying them. For instance, one company reporting on eight lines, all of four customers per mile, enters the analysis only once instead of eight times, as is the case in the grosser consideration. Some companies report different lines with different numbers of customers per mile. In these cases the different quantities are included in the analysis as separate entities.

But refining the analysis in this way does not greatly affect the results. As a matter of fact, it makes the average number of cusomers per mile appear actually higher (4.79 as against 4.64) because it gives greater weight to the exceptionally high data like 18 and 30 customers per mile.

Column No. 18—*Per Cent Range of Regulation*—The average range of regulation as shown by these data is 10.7 per cent, a not surprising result in view of the 91 out of total 185 entries that show 10 per cent range. Regulation ranges below 10 per cent and down as low as 3 include 41 entries and above up to 20 per cent there are 53. The difference in number of entries above and below 10 per cent is hardly great enough to justify a conclusion that the voltage range on rural lines is becoming wider. The data in this column plus the information on types of regulators in column No. 7 can very probably be taken as evidence that there is no widespread disposition to let the rural voltage wander where it will.

Transformers

Column No. 19—*Minimum Sizes and Types of Transformers*—No conclusion as to most generally used size of transformer can be drawn from these data, but it can be said that the 1½- and 3-kva. sizes share the honor with respectively 84 and 80 entries in the total of 197 in this column. The remaining entries include 20 of 1 kva., nine of 2.5, three of 5 and one of 7.5.

It is quite probable that the data in this column do really indicate a definite trend

Why Costs of Rural Lines Must Be Widely Variable

(Excerpts quoted from letters accompanying submissions of data)

"Cost figures vary widely with the number of curves, tree trimming work, etc. The figures given for primary line are for cases in which conditions are reasonably good. Extra guy anchors and clearing work will add to the cost."

"Estimated costs per mile of line cover a moot question. I have seen estimates on this item ranging from $500 to $1,500 per mile. (Editor's note: Observe that this range, wide as it is, is considerably narrower than that encompassed by the figures in the table.) I am inclined to believe too much emphasis has been placed on theoretical estimates based on ideal conditions that seldom exist. Rough, hilly ground will cause a material increase in line material as well as in labor required. We recently constructed 2.2 miles of line in which 25 per cent of the poles had to be longer than the minimum and 35 per cent had to be of a better class. Other things that raise cost are rock holes, railroad crossings, right-of-way expense, heavy trees, etc., all of which are common in our territory. Building lines in the hills where there are many rocks, trees and curves cannot reasonably be compared with construction on the prairies or over meadow land, where conditions are much easier."

"The territory we serve consists of a certain area of flat valley land and a large region of rough, broken, foothill country which is densely wooded. In addition, this country is covered with telephone and telegraph lines and the state has recently adopted rules compelling all wire companies to use joint poles along state highways. With the conditions we meet here it is impossible to lay out a standard that can be followed in all of our territory."

"While we have built a number of extensions within the cost shown on our reply to your question, there are many instances in which the cost is much higher than that shown. It is impossible to set up a definite unit price per mile. For instance, some extensions require no expenditures for rights-of-way or for tree trimming, whereas in others these two items alone may be 25 per cent of the total cost."

"It is true with this company, just as it is with many others, that there is no way of telling what the cost of mile or rural line will be until the actual survey has been made and the conditions that have to be overcome are fully known. We have found it possible to construct a mile of line serving one or two customers for as little as $900. On the other hand, we have found it necessary to expend as much as $2,500 to build another mile of line to serve a single customer."

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toward the use of single primary terminal transformers in spite of the fact that this type is stated in only 30, while the ordinary distribution type is indicated in 164 of the 194 entries. This type of transformer is suitable only for grounded neutral Y systems. This consideration automatically reduces the possible number of ST transformer entries that might have been made to about 100. In view of this fact it may be concluded that the single bushing transformer has done very well indeed to cover nearly a third of its possible field in the fairly short time of its promotion for rural service.

Costs

Column No. 20—*Estimated Cost per Mile of Primary Line Only*—The average of the 174 entries in this column is $773. It is obvious that not all costs in the table are of the single-phase extension. Some, very plainly, are for three-phase lines. But it does not seem that differences between the two are sufficient to upset conclusions based on lumping both together as is done. The highest cost entered is $1,810 (line No. 80). This is for a line of very short spans and for ten customers per mile, almost urban construction. Also, it is to be noted that the cost of the completed line is given as $2,200, which indicates only $39 as the per customer cost of transformers, secondaries, services, etc. Quite evidently more than just the bare primary extension is included in the cost of $1,810. However, it may not be argued that this is a reason for throwing out from consideration line No. 80 or any other in which the primary cost appears disproportionately high, because exactly the same disproportions can be found in low-cost lines. Examine line No. 7. Here is a long span line with conductors and transformers of types specially designed for rural service and the cost per customer above the primary line only is $32.50. Of the 174 entries, only 21 are of $500 or less. This indicates, apparently, that the engineers who must accept responsibility for the design and operation of rural lines are not yet convinced that low cost is the single desideratum.

On the other hand, 27 of the 173 entries are of $1,000 or more, but it must be admitted that seven of these are from one company and are presumably the expression of a single engineering philosophy. Discounting this consideration to its proper value, there is left a number of entries of lines costing $1,000 or more practically equal to the number costing $500 or less. Seemingly, the extremists at each end of the scale are mutually cancellable. This conclusion is supported by the fact that the average of costs above $500 and less than $1,000 is $709. But really these averages prove little; they are useful only as they indicate a reasonable mean of cost with present-day methods, materials and equipment toward which rural line design is generally moving. The only unquestionably valid conclusion that can be taken from these costs with their range from a low of $320 to a high of $1,810 is that it is unsafe for the engineer and unfair in the politician to give the American people any reason to think that the cost of a rural service line can be expressed in any generally applicable way except as a range between widely separated extremes.

Column 21—*Estimated Cost per Mile of Line Complete for Service*—The average of the 172 entries in this column is $1,236. Discarding the same extremes of primary line cost of $1,000 and above and $500 and below as was done in the analysis of column No. 21 results in an average of $1,158 for complete lines in the median range. As in the previous case, these averages really are of little significance; the true aspect of the matter lies in the range between extremes. At the bottom of the cost range is a complete line ready to service its customers built for $600 per mile and at the top is a cost of $2,300 defined in the same general terms.

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GENERAL ELECTRIC

FIELD OPERATING PRACTICES

New ideas and practices in the operation of well-designed, constructed and maintained plants and systems

Modernized Breakers Cut Upkeep $5,000

By J. H. PAGET
Manager Operating Department,
Carolina Power & Light Company,
Raleigh, N. C.

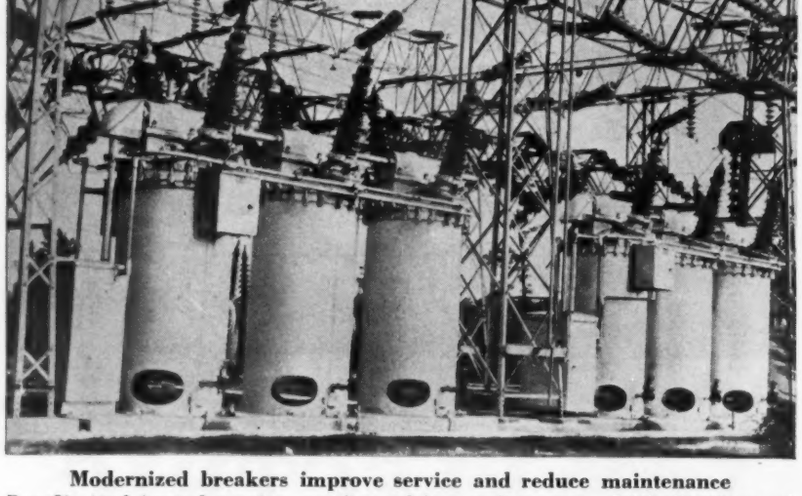
About two years ago the Carolina Power & Light Company obtained oil-blast parts from the General Electric Company to modernize nineteen of its FHKO-139 oil circuit breakers, in order to obtain greater interrupting capacity and higher speed of operation. These modernized breakers have now been in service about two years and their performance shows that great improvements in oil circuit breaker interrupting structures have been made by the manufacturers in recent years.

The operating time of the original breakers was speeded up from 25 cycles to 8 cycles. This increase in speed has practically eliminated out-of-step conditions which formerly gave us considerable concern. Service naturally has been greatly improved. When fault currents remained on the system for 25 cycles the unstable conditions caused interconnections with other systems to be broken, and this resulted in complaints from purchasers of power. However, with the 8-cycle clearing, as obtained with the modernized oil-blast breakers, the effect on the system is generally to cause only a single quick light flicker.

Particularly pleasing is the reduction in maintenance; first, on the breakers themselves and, second, on the connected apparatus and lines. We estimate the saving in maintenance on the nineteen oil-blast breakers to be $5,000 per year and, with this saving, it will be only a few years until the entire cost of the modernization is liquidated.

The saving in maintenance on the breakers results from the short duration of the arc. In the original breakers the arcing time ranged from 8 to 15 cycles, while in the modernized breakers arcs are interrupted in 2 to 4 cycles. Before modernization it was necessary to service the breakers quite frequently because the oil became carbonized and the contacts required inspection and redressing. Now the oil remains in good condition for long periods and there is practically no burning of contacts.

Installation of the modernization parts, the cost of which was comparatively small, was handled entirely by our maintenance crews, assisted by very complete instructions furnished by the manufacturer. Taken all in all, it has been a profitable undertaking; in fact, the results have exceeded our fondest expectations.



Modernized breakers improve service and reduce maintenance

Benefits tend toward greater security and less maintenance. Little likelihood of damage from the stresses set up by the short-circuit currents because they are removed so rapidly. Less burning of line conductors by the arc hanging on for long periods. In case of apparatus failure there is less damage because the fault is cleared in so short a time.

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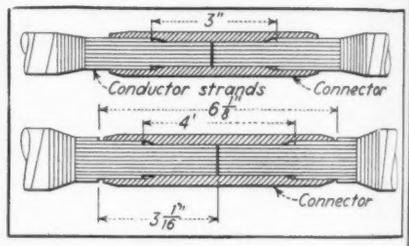
Improved Connection for Duct Splices

By E. R. VIETZEN
Street Department,
Commonwealth Edison Company, Chicago

Reductions by about a third in the time required for making duct splices in 5- and 12-kv. cables is accomplished by a new kind of connector sleeve used by the Commonwealth Edison Company. More than 200 splices made with the conductor joints supply the experience on which this statement is based.



Conductor sleeve reduces size of duct splice

Also it cuts down the time to make a splice by about a third. Upper sketch shows connector used on cables up to 500,000 circ.mil and connector for that size appears in lower.

In a duct splice it is essential that the diameter of conductor connections does not greatly exceed the diameter of the conductor itself, so the completed splice will comfortably fit into the duct. Splice sleeves with a maximum external diameter of $3\frac{1}{8}$ in. are used by the company.

The former method of making conductor connections consisted of interlacing one or more layers of conductor strands, soldering each layer in turn. The new connectors are used on multiple- and single-conductor cables in sizes from 300,000 to 500,000 circ.mil inclusive. On these conductors, except the 500,000, the outer layer of strands is cut back on the two ends to be joined. The connectors are made with a corresponding internal step. The 500,000 connection is made in the

same way except that two layers of conductor strands are stepped. The conductors are stepped by wrapping a binding wire at the point of step, nicking the strands with a hacksaw and then breaking them off by bending them back against the binding wire.

Although the connectors used in this method are only slightly larger than the conductors themselves, their center cross-sectional copper areas are actually greater than the conductors they join. There is thus no reduction of conductivity in the connection.

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Test Table Aids Transformer Testing

By A. FRANK AYRES
The Southern Sierras Power Company, Riverside, Calif.

To expedite routine testing and increase safety the test table shown was constructed. It does not constitute a complete transformer testing unit, but does serve as a convenient means of providing and connecting the necessary metering equipment used for all tests.

The terminal boards on opposite ends of the table serve independent sections of the table. Each section has its individual instruments and circuits and is arranged so that no interconnection between the two sections is possible. However, only one wattmeter is provided, a throw-over switch making it possible to use it with either of the two sections. The left-hand portion of the table contains testing equipment for currents from 5 to 200 amp. in six steps, the ratio of the potential transformer in this section being 20:1. The right-hand portion of the table is similarly arranged except that currents between 100 and 1,000 amp. can be measured through four current transformers, the potential transformer here having a ratio of 4:1.

Both sections of the table may be used simultaneously if desired in making such tests as polarity or ratio. Other routine tests which are greatly simplified by the use of this table are resistance, iron loss, exciting current, copper loss and impedance.

Portable test-table simplifies routine transformer testing and assures safety

Two ammeters, two voltmeters, a wattmeter, a wheatstone bridge and an iron loss voltmeter are recessed in top of desk. On vertical panel are switches for selecting instruments or circuits. Large round knobs control current-transformer selector switch. Pulling one connects both primary and secondary of selected transformer to proper circuits. Other switches permit selecting any of three scales on the voltmeters and ammeters. Instrument, transformers, switches and wiring are in inclosed rear portion. All primary live parts are insulated for 2,300 volts. Except for terminal panels on ends of table, each provided with hinged guard, no dangerous potentials are exposed.

Banding Rotors of D. C. Industrial Machines

By JOHN S. DEAN
Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

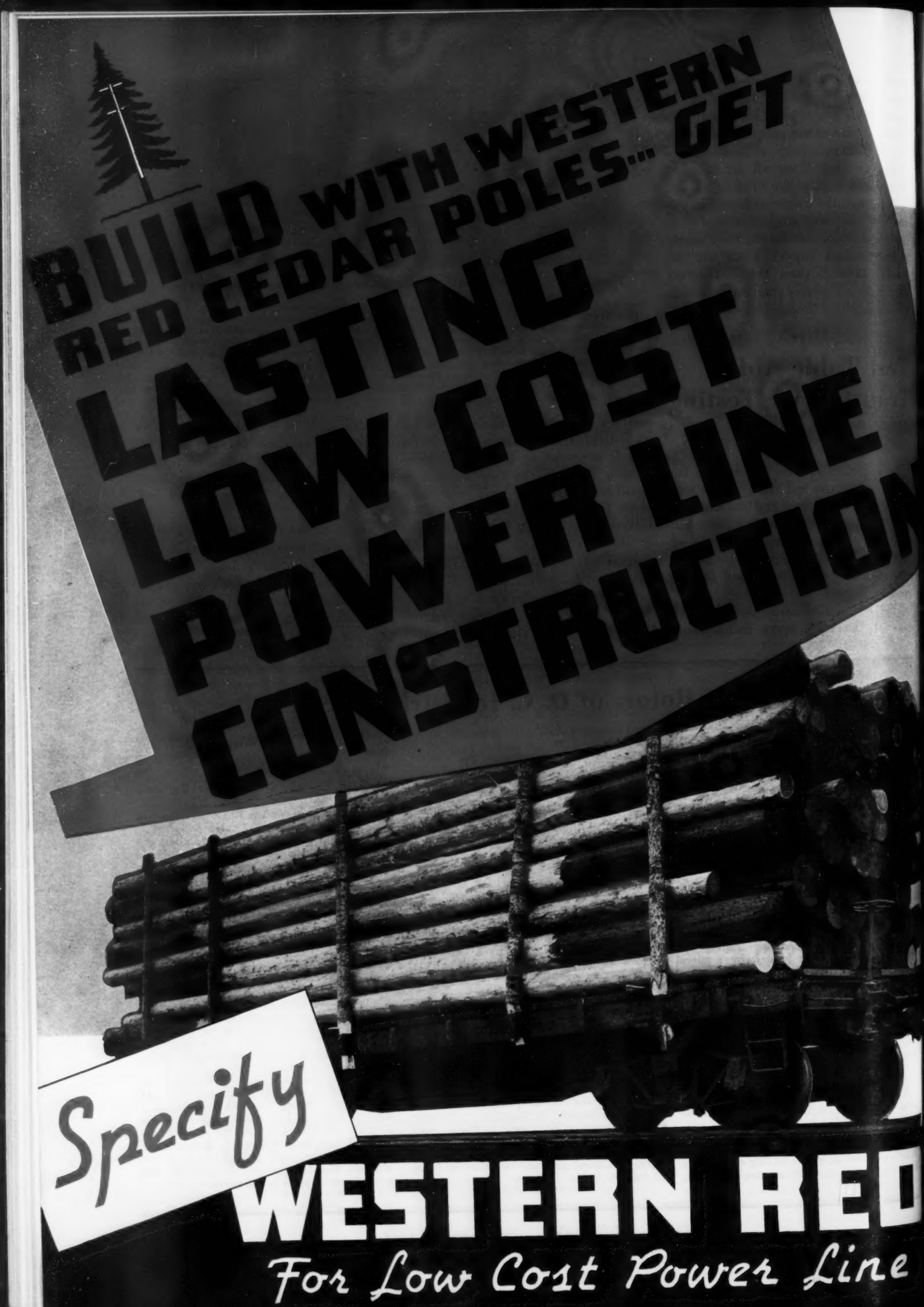
Careful and correct banding of repaired and rewound rotors of industrial machines will minimize the movement of the coils due to vibration, securely hold them in place and prevent chafing and wear of the insulation and grounding of the windings. In general, rotors of industrial machines are banded at room temperature, the procedure recommended being as follows:

1. See that all coils are well down in the slots so that the finished core bands will not extend above the iron core.
2. Form the end windings in a concentric circle about the shaft by tapping the high coils (which are located by a piece of chalk) with a mallet.
3. Make sure that the areas to be banded on the end windings are horizontal and not cone shaped. When necessary, build up with black friction tape.
4. On wedge-type rotors (without core bands) apply the proper size hard fiber wedges.
5. Rotors with core bands should have a strip of fishpaper 0.015 in. thick placed under each band. Some specially insulated armatures use a strip of 0.015-in. asbestos tape in place of the fishpaper.
6. Under the end bands of wedge-type rotors place two strips of 0.030-in. treated fullerboard and on rotors having core bands place two strips of 0.020-in. surgical braid, with a strip of 0.015-in. treated rope paper sandwiched between the surgical braid.
7. Tinned sheet-steel clips are used on the larger size rotors and tinned sheet-copper clips on the smaller ones. These are placed about 3 in. apart, spaced around the rotor with four clips at the start and finish of each band.
8. The insulation and metal clips are temporarily held in place by narrow string bands.
9. When starting to band a rotor having core bands anchor the end of the band wire by wrapping it about the core near the center core groove, then bring the wire under tension into the center core groove and run on the necessary number of turns.
10. Then proceed to the right to the next core groove, the right coil extension, and then back to the left-end core groove, and finally to the left-end coil extension.
11. The band tensions recommended are as follows:

Rotor Diameter, In.	Diameter of Banding Wire (Inches) 0.029	0.045	0.064	0.081
	Pounds Tension			
Up to 7½	25	100		
7½ to 10	35	125		
10 to 13		100	150	200
13 to 16		125	175	250
16 to 19		150	200	300
19 to 21			250	350

Note: Use a high-grade tinned steel banding wire.

12. While doing the above banding use a continuous wire and in no case should the band wire be loosened or the tension removed until the entire banding job is completed and the start and finish of the wire is soldered in place. Some slack may be taken up by forcing a screwdriver under the turns of wire, which temporarily connect adjacent bands.
13. When the above soldered joints are cool cut the wire from the tension device and solder the start and finish of each separate band.
14. Remove all excess banding wire, then form a hook at the start and finish of the band wire around the clips so that they lie flat on the armature. The length of this hook should not exceed twice the diameter of the wire used.
15. Bend over all clips and solder the entire surface of all bands, using half and half solder. When doing this work use a hot soldering copper, maintained at a temperature between 275 and 325 deg. C.
16. If any loose wires are found on a band after the start and finish clips are soldered this band should be removed and a tight one applied in its place.


BUILD WITH WESTERN RED CEDAR POLES... GET
LASTING LOW COST POWER LINE CONSTRUCTION
Specify
WESTERN RED
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NOTE THESE EXCLUSIVE QUALITY FEATURES OF

WESTERN RED CEDAR—

- Western Red Cedar Poles are straight, strong, rigid, yet light in weight.
- Their large heartwood, preserved by nature, is highly resistant to decay and insect damage.
- Western Red Cedar combines, in one wood, more basic power line pole properties than found in any other pole timber.
- The natural preservative of Cedar is permanent . . cannot be varied, and is constant and effective from the top to the bottom of the pole.
- Additional gains can be added and holes drilled anytime after erection for joint use or for installation of additional equipment without endangering the life of the pole.

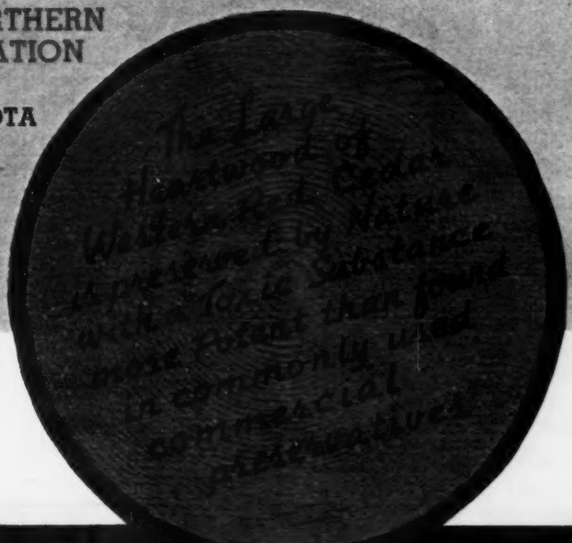
Western Red Cedar Poles cost less to haul, to handle, and to set because of light weight. Their natural taper and low center of gravity makes possible a more rigid power line—this stability saves re-alignment costs after storms and years of service. Fewer guys are needed for cedar even in wet, sandy, or exposed locations. The large butts with added weight of creosote save on depth of holes required for firm anchorage.

The great strength of Western Red Cedar Poles in the line makes longer spans practicable. Their inbuilt, lasting resistance to decay assures maximum service life at minimum inspection and maintenance costs. The clean surface and uniform texture of Western Red Cedar Poles make them easy to handle and to climb. Attachment of crossarms and brackets, fastening of braces and guys, installation of transformers, switches, and other apparatus after erection can be done at any time and without endangering the life of the pole.

Build with these time-tested fine poles and get the utmost in good power line construction.

WESTERN RED AND NORTHERN
WHITE CEDAR ASSOCIATION
Metropolitan Bank Building
MINNEAPOLIS, MINNESOTA

The vast forests of Western Red Cedar assure a continuous, ample supply to meet the full requirements of the utilities.



D CEDAR POLES

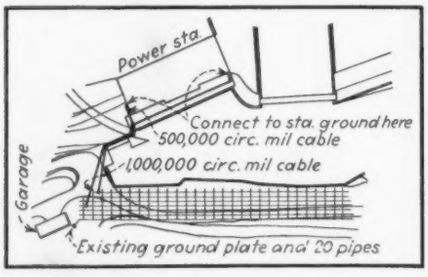
e Construction and Maintenance

NEW ENGINEERING IDEAS

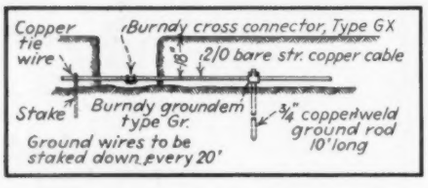
Discoveries, proposals and developments by electrical engineers and scientists in the field, the factory and the laboratory

Grid System Affords Good Station Ground

In providing for the grounding of steel structures and apparatus in the switchyard and power house of Cabot station* the Turners Falls Power & Electric Company installed a ground grid system in the sandy clay soil of the switchyard itself which resulted in a ground having a total resistance of 0.25 ohm.



Grid provides ground for switchyard structures and power station


Copper tie wire
Burndy cross connector, Type GX
2/0 bare str. copper cable
Stake
Burndy groundem type Gr.
¾" copperweld ground rod 10' long
Ground wires to be staked down every 20'

Method of making cross-connections and connections to ground rods

One hundred and twenty-five ground rods ¾ in. in diameter and 10 ft. long were driven along the perimeter of an area 600 ft. long and 70 ft. wide. The rods were connected by longitudinal and crosswise cables of No. 2/0 stranded copper to form a grid as shown in the diagram.

Connections between the individual ground rods and the No. 2/0 cable as well as tee and cross-connections between cables of the grid were made with solderless clamp connectors in the manner shown in the accompanying sketch. Two 1,000,000-circ.mil cable were used to connect the ground grid to the station ground.

Depth of the clay soil in which the cables and ground rods were buried is about 2-3 feet above ledge rock along the canal wall. This ledge slopes at an angle of 25 deg. away from the wall and the depth increases correspondingly. Along the side of the grid away from the canal the layer of clay has a depth of about 30 ft.

*See ELECTRICAL WORLD, December 31, 1932, page 884.

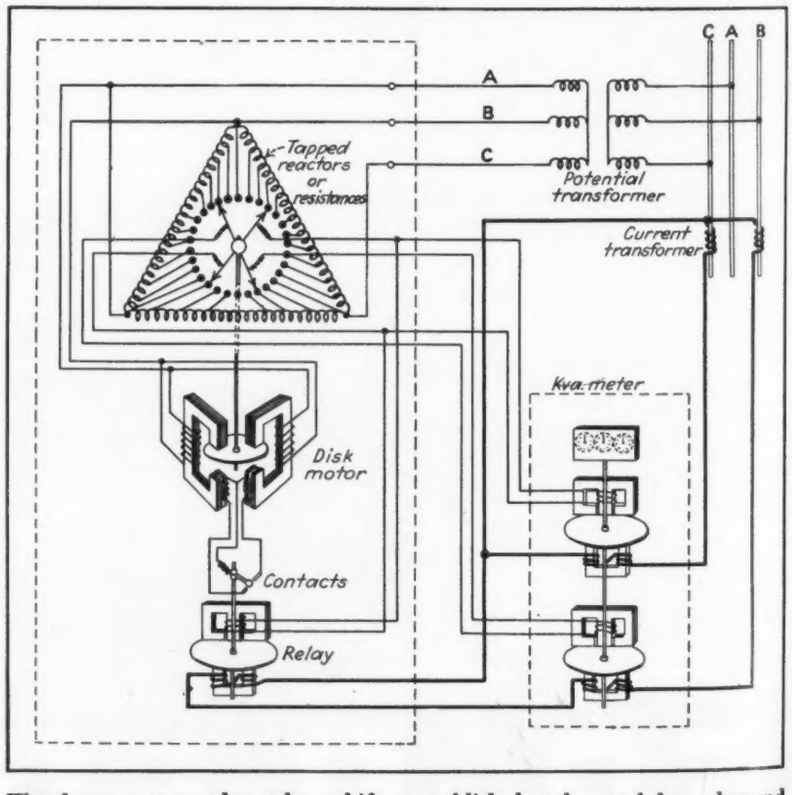
•

Meter With Relay Reads Kilovolt-Amp.

While the fundamental scheme is not new, there are new details in a kilovolt-ampere-hour meter devised by W. Casson and A. H. Gray and reported at a recent meeting of the Institution of Electrical Engineers in London. It employs a standard watt-hour meter (with or without demand indication) and a power-factor compensator which comprises a relay to actuate a small disk motor which adjusts a three-phase shifting device.

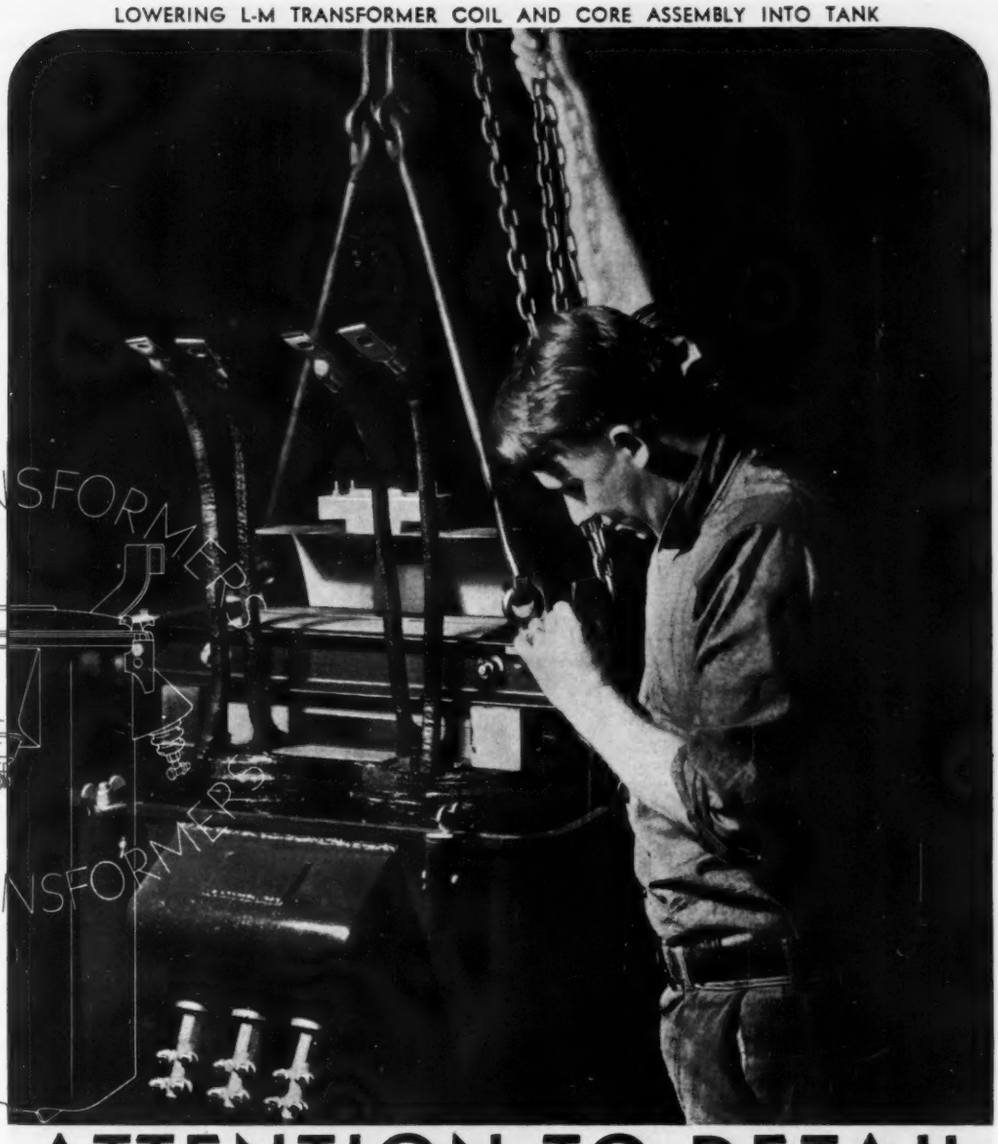
The power factor is merely a meter's motor-element precisely calibrated for power factor and supplied with a contact-making arm that actuates the motor circuit whenever the apparent power factor at the watt-hour meter and relay is not established at unity, whatever the load circuit power factor. Two pairs of brushes rigidly fixed at 60 electrical degrees displacement move over the 36 contact studs tapped from the delta-connected resistors or inductors so chosen as to give a succession of 10 degree shifts. In order that tapped voltage shall not be interrupted or substantially raised for appreciable length of time a Geneva escapement is inserted to cause intermittent motor motion that places the contacts full on a contact segment. The error introduced by the 10-degree stages (as compared with infinite divisibility of the compensator) is stated to be 0.4 per cent.

Calibration is simple in that only unity power factor is required to be established in the test of the watt-hour



Watt-hour meter, relay, phase-shifter establish kva.-hr. and kva. demand

LOWERING L-M TRANSFORMER COIL AND CORE ASSEMBLY INTO TANK



1 Ø, 1½ to 200 KVA.
Up to 13,800 Volts.

ATTENTION TO DETAIL IN L-M TRANSFORMERS

Tanks of copper bearing steel, electrically welded throughout, are corrosion resistant, assure oil-tight transformers. Channels or angles welded to tank bottom add strength, eliminate wear during handling.

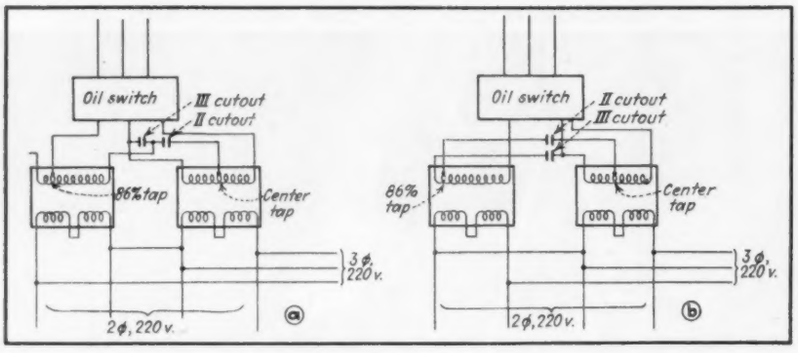
One size hanger for all sizes of transformers simplifies storing. Hanger does not project below tank bottom, is easily adjusted in height. Rear angle brackets permit use of universal steel kickarms.

Two name plates of stainless steel, welded onto tank side and low voltage pocket, make identification easy on pole and in storeroom.

More reasons why "L-M TRANSFORMERS ARE BETTER TRANSFORMERS."

LINE MATERIAL CO.

SOUTH MILWAUKEE, WISCONSIN, U. S. A



Transformers convertible from Scott to open delta arrangement provide two- or three-phase power as desired

(a) Connections as used. (b) Suggested improved connections.

meter and the power-factor relay, the other equipment being of fixed characteristics.

•

Two, Three Phases From Same Service

By K. B. HUMPHREY
Sayreville, Pa.

Necessity of having either two- or three-phase current available in one location at all times resulted in use of the unique connection system herein described. A fire pump, used occasionally and requiring two-phase, 60-cycle power at 220 volts, is supplied from a 2,300-volt, three-phase source through two 50-kva. transformers, Scott connected. In the same vicinity are several conveyors operating on three-phase, 220-volt current. Connections shown in the accompanying diagram were used to supply three-phase power for the conveyors and yet have two-phase power available at a moment's notice to serve the fire pumps.

As shown, an oil switch in the primary circuit controls the high-voltage supply to the transformers. Also in the primary circuit are two cutouts which are used to switch transformer connections in changing from two- to three-phase connections as desired. Opening plug III and closing plug II makes two-phase power available for the fire pumps. Opening plug II and closing III provides three-phase power for the conveyors.

Although the diagram shown in (a) is the original hook-up, it does overload the teaser winding of the Scott transformer when three-phase power is used. This unbalances the voltage to some extent, but since the three-phase load is light the system has operated for some time without trouble. An improved wiring scheme is shown in (b), which will give the same results without the voltage unbalance. The first system might find application where only a transformer with 86 per cent tap was available.

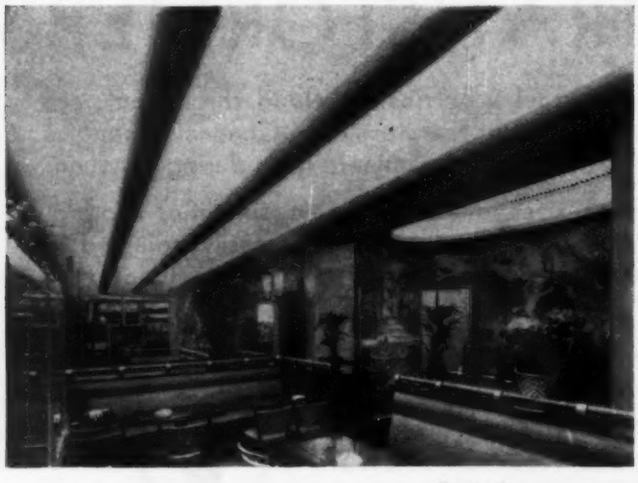
•

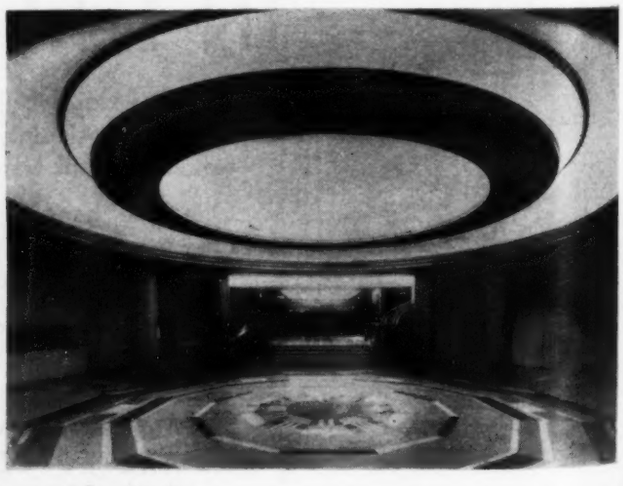
French Blend Colors in New Lighting

By A. L. POWELL
Supervising Engineer, Incandescent Lamp Dept., General Electric Company, New York

Observation of the most decorative lighting installations in Paris reveals that a high percentage of the new work employs gaseous conductor light sources instead of the old standard practice of using incandescent lamps. A pinkish white light effect is secured through the combination of one neon tube with two mercury tubes with fluorescent coatings. The resultant flux from this combination is most pleasing, indeed. Such equipment is used in indirect troughs, indirect coves, semi-indirect suspended troughs, as well as exposed. This trend is worthy of attention, for while many of the jobs could not be justified from a strictly economic standpoint, evidently the owners feel the novelty justifies an increased expense of installation and operation.

Among the outstanding installations of this type are the Café du Triomphe, restaurant Le Trianon, Cinema Paris Soir, Cinema Le Marignan, Café Le Weber, shop of Mellerio and the showroom of Ocel.





Paris fuses neon and mercury luminosity

(a) Restaurant "Le Trianon." In indirect coves are placed neon and fluorescent mercury tubes, the product of Claude Paz et Silva.

(b) Grand foyer of cinema "Le Marignan." Totally indirect system. Colored flux from gaseous conductor sources directed toward white ceiling. Central area brilliantly red from neon tubes of red glass. (This filters out the orange of the neon spectrum and produces a deeper color.) Next ring deep blue from mercury tubes in blue glass. (This filters out the green and yellow the mercury spectrum.) Outer ceiling area is white in appearance from a combination of neon and fluorescent mercury tubing. Resultant illumination is pleasing mixture of color. Walls and columns are terra cotta and floor composition patterned in rose, buff, orange and black. Claude Paz et Silva designed.

Sheath Corrosion at Bond Straps Prevented

[*Continued from page 38*]

more convenient in crowded manholes to permit the bond strap to run along the cable. However, it is our practice to require all bond straps to be brought out at right angles to the cables. This procedure alone will, in most cases, eliminate galvanic corrosion.

Protective coatings used

As a further protective measure for those cases where the fireproofing will come in contact with the erect bonding strap, it has been the practice for several years to coat the cables in the manholes with an application of hot asphalt and muslin. This is also done to protect the lead from the slower direct chemical corrosion from the alkali in the cement and in the oil pressure cables to protect against the galvanic corrosion between the brass fittings and the cable joint sleeves.

Experiments have been made with paraffined cheesecloth and with hot applications of paraffin over cheesecloth wrapped around the cable. After one year definite corrosion was found to take place where the bond strap was imbedded in the fireproofing. The paraffined coatings became brittle at the lower temperatures and failed to give a continuous membrane and corrosion took place.

Experience over a period of three years has shown that the methods adopted to prevent this type of corrosion are effective. Experiments are still being conducted on more readily applicable protective coatings and on less active types of fireproofing materials. Use is now being made of these less active fireproofing materials.

•

Tasmanian Development Hires Vancouver Engineer

Australia's state of Tasmania wanted an engineer to build and operate its 105,000-hp. power system, couldn't find him in the Commonwealth, so imported H. K. Dutcher from Vancouver, B. C. Already about $7,500,000 has been appropriated for the project and Mr. Dutcher, now in charge, expects to deliver the first power next December.

The plant, on the Derwent River, 75 miles from Hobart, is in wild, mountainous country. So when the engineer from Canada set to work he had roads, canals and a townsite to build, as well as dam and power lines.

SUPERIOR
REG. U. S. PAT. OFF.

*(BAIS-20)

HERE'S THE MOST

ALERT WATCHMAN

YOUR MONEY CAN HIRE!

Let Superior Meter Enclosures watch over your revenue.

Put your naked meters in Superior Enclosures. Discourage current diversion—Eliminate fire and safety hazards—treat your meters like you do your cash and records—Lock 'em up.

Our business is to help you get paid for all energy consumed. "Ask and ye shall receive" A "Compact Enclosure Bulletin".

Superior Switchboard & Devices Co.
Canton, Ohio

*Been at it Since 1920

SUPERIOR
REG. U. S. PAT. OFF.

BUILDING UP THE LOAD

New ideas and practices in selling electrical equipment and service to industrial, commercial and domestic customers

Training Salesmen for the Dealers

Early last year the Electrical League of Cleveland employed a sales director and established a sales school to train refrigeration salesmen for dealers, to help them meet the 20,000 bogey set up for league members for 1935. Dealers sent salesmen already in their employ and later hired additional men with the co-operation of the director. These men were enrolled in a six-day course, beginning daily at 1 o'clock and running often into the evening. The league paid each student $1 a day and the dealer another dollar during the course.

Some 200 men and 33 women went through the school, spending much of their time in actually pushing doorbells and approaching customers. The women were used largely as prospect hunters and paid a commission on the leads they produced which resulted in sales. During eleven weeks of this course Monday breakfast meetings were held at the Electrical Institute to all students and sales people who arrived before 8 o'clock. The attendance averaged 250 and outstanding men from the refrigerator industry addressed them.

Salesmen who sold five refrigerators received a merit button marked "5" and a prize—which was replaced with silver and gold buttons as the individual sales reached 15 and 25. Each winner received also a prize selected by a punch board. Total sales were so stimulated by this instruction that distributors had reported 19,776 refrigerators sold to local dealers in the first eight months of last year.

Out of the success of the refrigeration course, the league has been conducting five classes on how to sell home lighting, air conditioning, kitchen appliances, how to make more sales and group selling and effective speaking. With 119 students enrolled, there have been 195 applicants waiting for the next series. Meanwhile, 50 home-lighting advisers are being trained for work in the field.

•

We Lived and Ate with Them

By GEORGE BAUMAN
Union Gas & Electric Company, Cincinnati

In a recent electric range campaign conducted over a period of four months in one of the outlying suburbs of the city of Cincinnati, with a population of 1,000 families, we succeeded in placing 100 ranges. Approximately 300 of these families already had electric ranges, purchased over a period of many years.

We opened a temporary store to display several of the moderately priced ranges, which were installed on the rental plan—$2 a month over a period of 54 months, totaling $108. This cost included the necessary wiring to service the range. Three men were placed in the field to call on every resident in the community, to explain in detail all angles of the advantages of electric cooking.

Because of the sincerity in the presentation and absence of pressure methods we succeeded in making many friends among these customers, especially when they found that the service bill did not exceed our estimate. Cancellations were less than 5 per cent. Our home economics department gave five cooking demonstrations and we also obtained prospects through many of the present range users, for which we gave each one a two-dollar merchandise order, provided the prospect was sold within 60 days.

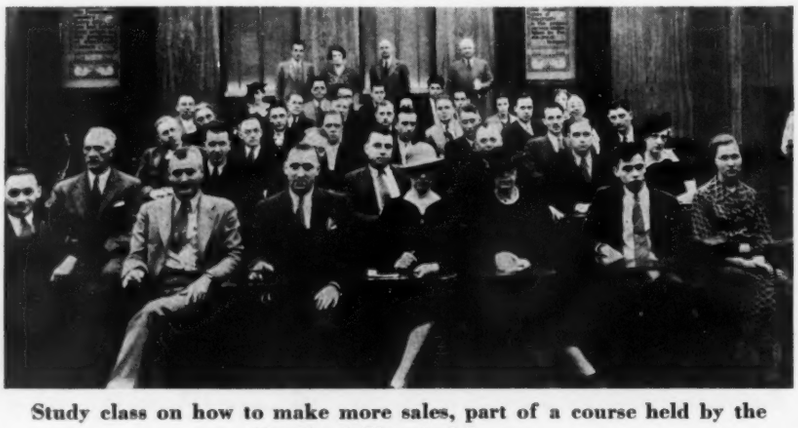
This community is composed of families of moderate circumstances, a large number of the women doing their own cooking, and the secret of our success lay in the fact that we literally "lived and ate with them."

•

Air-Conditioning Sales—58 Power Cos.

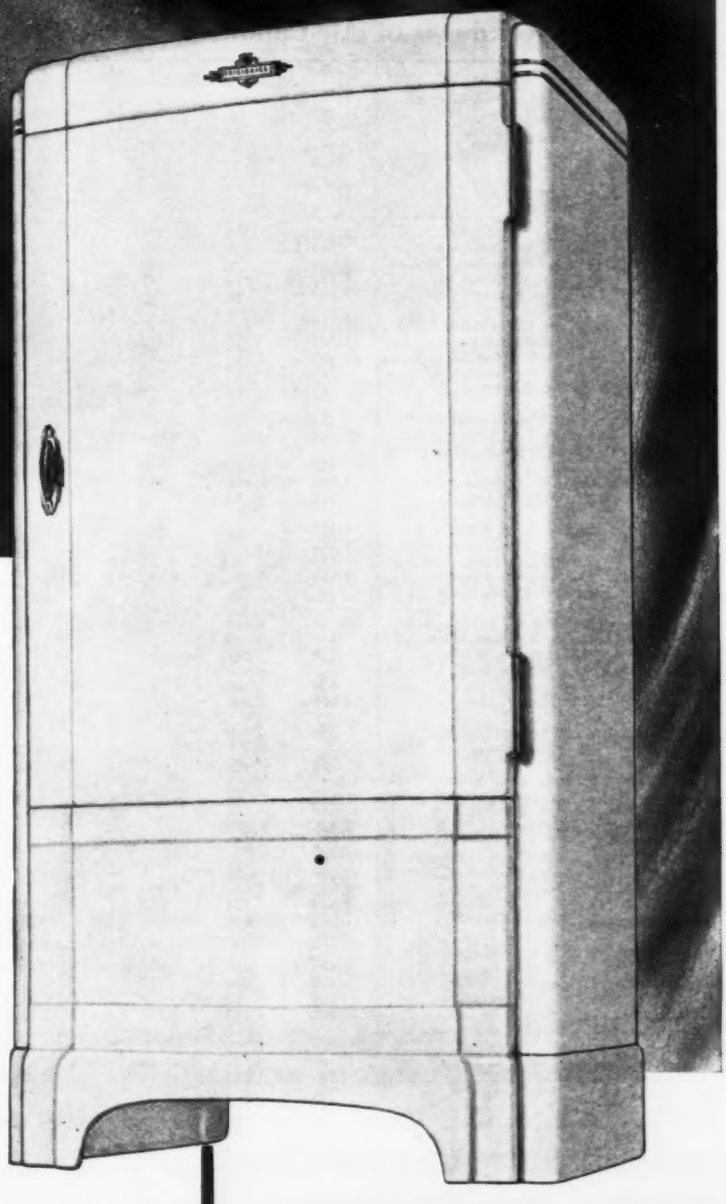
Marked gains were made last year in air-conditioning business. The 58 power companies shown in the accompanying tabulation increased their connected load by nearly 25 per cent, adding 51,981 hp. to the previous total of 224,838 hp. This compared with gains of 33,124 hp. in 1934 by the companies reporting, as shown at the foot of the table.

Residence air conditioning led in number of new installations in spite of the fact that many feel that this market is not yet ready. There were 688 household jobs completed by 42 companies and they averaged 2 hp. in size. Next in number came 310 restaurant installations, 228 offices, 141 retail stores, 130 office buildings, 62 hotels, 59 theaters, 56 department stores, 37 beauty parlors, 19 barber shops, 20 furriers and some 983 miscellaneous installations in which saloons, funeral parlors, florist shops and clubs were prominent. These totals do not indicate the salability of these different types of customers, for some utilities put the pressure on one



Study class on how to make more sales, part of a course held by the Cleveland Electrical League

HIT I "METER-MISER"



Five-Year *Protection* Plan

Frigidaire places such faith and confidence in the Meter-Miser that this sealed-in mechanical unit, a marvel of outstanding design and engineering, comes to your customers protected for Five Years against service expense.

FRIGIDAIRE
MADE ONLY BY GENERAL MOTORS

The New Name-Plate is a Salesman in Itself

Frigidaire is made *only* by the Frigidaire Division of General Motors Corporation. Your prospects are being educated to look for this name-plate before they buy.

The 1936 Frigidaire Line Includes

FOUR MASTER MODELS

from 4.1 to 7.24 cu. ft. capacity. All with Dulux Exterior, Stainless Porcelain in Seamless Interior and a long list of other superior advantages.

In addition there are the Koldchest, 2.1 cu. ft. capacity . . . and the D3-36, 3.3 cu. ft. capacity.

FIVE SUPER MODELS

from 4.1 to 9.1 cu. ft. capacity. All with Porcelain Exterior and Interior, Portable Utility Shelf, Hydrator and the Quickube Ice Tray, in addition to all other Frigidaire advantages.

FOUR EXTRA-SIZE AND DE LUXE MODELS

from 10 to 15.1 cu. ft. capacity.

TWO SPECIAL MODELS

5.1 and 6.24 cu. ft. capacity.

FRIGIDAIRE OFFERS THESE OUTSTANDING SELLING FEATURES

Meter-Miser · Food-Safety Indicator · Wider, Roomier Interior · Portable Utility Shelf · Full-Width Sliding Shelves · Automatic Interior Light · Frigidaire Hydrator · Super Freezer · Automatic Reset Defroster · Automatic Ice Tray Release · Quickube and Rubber Grid Ice Trays · "Double-Range" Cold Control · Sealed Steel Cabinet finished in Dulux or Porcelain · Touch-latch Door Opener · Exclusive "F-114" Refrigerant.

FRIGIDAIRE CORPORATION · DAYTON, OHIO

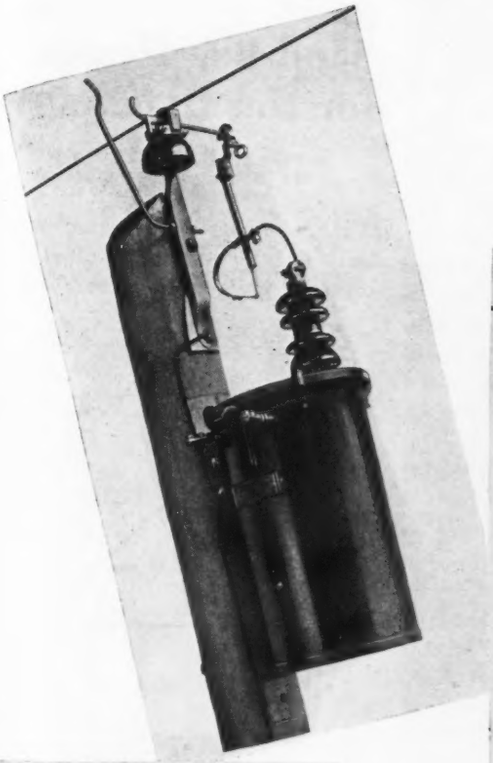
field and some on another, as indicated by the fact that 47 companies sold to restaurants, 34 to office buildings, 27 to hotels, 15 to retail stores and furriers, 13 to barber shops and offices and 11 to theaters. In point of the size of installations, the department stores averaged 106.3 hp., theaters 73 hp., office buildings 71 hp., hotels 41.9 hp., restaurants 18.4 hp., retail stores 18.1 hp. and offices 10 hp.

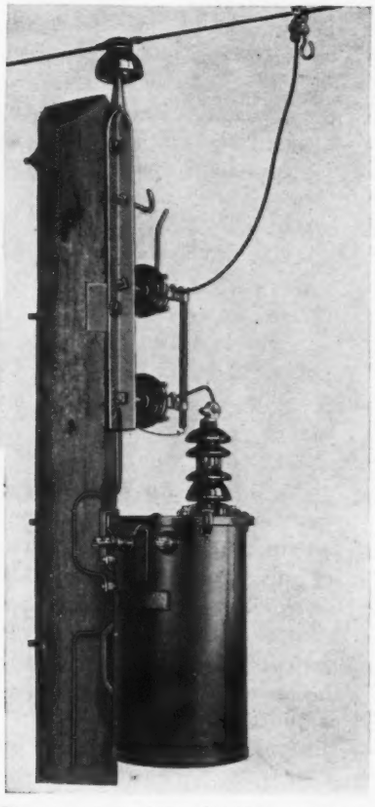
Methods of selling also differ—20 companies reporting that they are selling air conditioning themselves, while 38 leave the retailing entirely to local dealers and 42 provide engineering advice. Reports from 30 companies show a total of 196 air-conditioning salesmen on full time and 41 companies report 92 engineers on air conditioning; 52 companies report 421 dealers in the business. These dealers receive co-operation from these power companies in varying degree, ranging all the way from a well set-up local co-operative air-conditioning bureau down to the usual dealer helps, advice, co-operation newspaper advertising and window displays and leads turned in by company salesmen. Only 19 companies report that they finance air-conditioning sales—usually on 24 months time.

Breakdown of Air-Conditioning Installations by Types of Establishments

Company	Present A.C. Load in Hp.	Approx. Hp. Added 1935	Approx. Hp. Added 1934	Hotels—No.	Restaurants—No.	Beauty Parlors—No.	Barber Shops—No.	Theaters—No.	Offices—No.	Retail Stores—No.	Dept. Stores—No.	Office Bldgs.—No.	Furriers—No.	Residential—No.	Miscellaneous—No.	Sell Direct?	No. Dealers Selling A.C.
Alabama Pw. Co., Birmingham, Ala	1,209	402	178	4							1	1	1	9	14	Yes	5
Arkansas P. & L. Co., Pine Bluff, Ark	264.5	229	13		4		1					1		7	10	Yes	7
Pacific G. & E. Co., San Francisco, Cal	4,624	699	407													Yes	22
San Joaquin L. & P. Co., Fresno, Cal	1,732.78	394.28	111.15		7	1					1	2		15	29	No	13
Pub. Serv. Co. Colorado, Denver, Colo	1,007	96	26	3	2									31	11	Yes	7
Southern Colorado Pw. Co., Pueblo, Colo	112	35.5	22	1	1						1	1			1	Yes	5
Hartford El. Lt. Co., Hartford, Conn	1,002	172	507		4	1					2	2	1	2	16	No	5
Potomac E. P. Co., Washington, D. C	27,590	7,033	9,442	7	17	1		5	20	8	5	13	1	35	30	No	18
Savannah E. & P. Co., Savannah, Ga	248	33	0									1		2		No	3
Central Ill. E. & G. Co., Rockford, Ill	97.5	62.5	35													No	5
Central Ill. Pub. Serv. Co., Springfield, Ill	173	158	15		6										6	No	3
Commonwealth Edison Co., Chicago, Ill	48,614	5,240	5,410	2	47	7	1		27		2		3	24	185	No	30
North. Indiana Pub. Serv. Co., Hammond, Ind	320	65	100		1							1			1	No	
Indianapolis P. & L. Co., Indianapolis, Ind	2,800	1,400	880		7	1	1			6	3	1				No	7
Kansas E. P. Co., Lawrence, Kan	372	55	18		1							1		3	1	Yes	5
Kansas G. & E. Co., Wichita, Kan	1,495	513	200	6	15		3		32	13				57		No	8
Cons. G. E. L. & Pw. Co., Baltimore, Md	7,783	2,202	1,814		27	5		32	51	43	13	6		23	25	No	10
Potomac Edison Co., Hagerstown, Md	135	58	25	2	1	1		1	7		2	1			5	Yes	12
Edison Elec. Ill. Co., Boston, Mass	8,938.5	1,501.5	2,711	3	10		1				10	9	3	3	12	No	12
United El. Lt. Co., Springfield, Mass		248.5		1	3							7		1	5	No	14
Detroit Edison Co., Detroit, Mich	13,150	1,165		2	8						1	21		14	36	No	21
Mississippi P. & L. Co., Jackson, Miss	138.3	98.5	38.5		1	2						1		11	19	No	15
Consumers Pw. Co., Jackson, Mich	733	220	408	1	8			7	28	3	2			12	10	Yes	20
St. Joseph Ry. Lt., Ht. & Pow. Co., St. Joseph, Mo	220	65	30	1	2	1								2		Yes	3
Union L. & P. Co., St. Louis, Mo	14,081	5,266	1,260	2	16	1				25		1		65	69	No	34
Missouri P. & L. Co. Kansas City, Mo	200	110	90		2			2	1			2		8		No	4
Pub. Serv. Co. of New Hampshire, Manchester, N. H	70	41	7		2			2		1	1			3		No	6
Jersey Central P. & L. Co., Asbury Park, N. J	110	85	25		1						1	4		3	1	Yes	
Elmira Lt., Ht. Pw. Co., Elmira, N. Y	18	12	6	2								3				Yes	3
Brooklyn Edison Co., Brooklyn, N. Y	7,286	1,824					79									No	10
Long Is. Lt. Co., Suffolk County Div., N. Y	10	5	5											5	1	Yes	6
Rochester G. & E. Corp., Rochester, N. Y	2,493.25	602.25	513	1	3	1				1		1	2	8	10	No	7
Union G. & E. Co., Cincinnati, Ohio	7,932.75	2,451.32	1,309.75		6						2	2		31	52	No	15
Columbus Ry. P. & L. Co., Columbus, Ohio	2,529	323	752	1	4							2		8	12	No	10
Toledo Edison Co., Toledo, Ohio	1,901	426	0	1	2		1	1	4	3				2	9	No	12
Oklahoma G. & E. Co., Oklahoma City, Okla	2,423.8	831.24	350.01		4		1		16	8	1	1		21	1	No	12
Pub. Serv. Co. of Okla., Tulsa, Okla	1,104	304	177		1	1							1	13	13	No	6
Northwestern El. Co., Portland, Ore	300	81	50		1	1								30	20	No	5
Phila. El. Co., Philadelphia, Pa	21,885	4,640	2,267	2	13		2						1	24	66	No	14
Penn. Central Lt. & Pw. Co., Altoona, Pa	20.25	6.25	0										1		3	Yes	2
Penn. El. Co., Johnstown, Pa	26	26	0	2	1										3	No	3
Duquesne Lt. Co., Pittsburgh, Pa	5,539.75	1,343.25			12	4	3	1	19	17		1	1	28	5	Yes	10
West Penn. Pw. Co., Pittsburgh, Pa	286.45	113.05	27.9		1			4						5	1	Yes	10
Blackstone Val. G. & L., Pawtucket, R. I	209.5	0	36.18					2	2	3							
South Carolina Pw. Co., Charleston, S. C	120	10	0		1											No	1
Tenn. El. Pw. Co., Chattanooga, Tenn	1,625.75	509.75	146	1	4	2			9		7		1	2	14	Yes	10
Southwestern Pub. Serv. Co., Amarillo, Texas	30	28	2		1							1		1	2	No	3
Gulf States Util. Co., Beaumont, Texas	558	243	60	1	2		2				3	2	1	3	1	No	8
Dallas P. & L. Co., Dallas, Texas	5,073	1,234	440	3	4							4	1	18	39	No	15
El Paso Elec. Co., El Paso, Texas	525.5	44	69									1			2	Yes	3
Houston L. & P. Co., Houston, Texas	7,032	2,724	361	2	2		1				1	1		4	19	No	16
Virginia E. & P. Co., Richmond, Va	4,950	1,590	1,290		8	2					4	14	1	9	27	No	20
Washington Wt. & Pr. Co., Spokane, Wash	2,600	692	276	1					6	2				2	8	Yes	6
Milwaukee El. Ry. & Lt. Co., Milwaukee, Wisc	3,576.88	384.55	135.53	1	1				6	7		3		3		No	
Wisconsin G. & E. Co., Racine, Wisc	6	4.5	4.5									1		2		Yes	
Wisc. P. & L. Co., Madison, Wisc	50	11.33	0		1						1				3	No	12
West Texas Utilities Co., Abilene, Texas	130	79	30	2	8	1	1			1		10		3	1	Yes	0
Kansas City P. & L. Co., Kansas City, Mo	7,177.5	3,640.75	993.5	7	35	5	1					1	1	138	180	No	25
Sierra Pacific Power Co., Reno, Nev	200	150	50		2			2							5	No	2
Totals	224,838.96	51,981.22	33,124.84	62	310	37	19	59	228	141	56	130	20	688	983		441
Number of Companies	(58)	(58)	(47)	(27)	(47)	(17)	(13)	(11)	(13)	(15)	(21)	(34)	(15)	(42)	(44)		

DOWN GO RURAL LINE COSTS





Three types of combination gap and fuse assemblies are shown above.

Allis-Chalmers announces a combination Fuse-Pin-Gap Assembly, designed to reduce the cost of transformer installation on Rural Lines.

One of the three assemblies shown will cut your construction cost, afford proper transformer protection and provide a neat and durable pole top arrangement.

Ask the nearest Allis-Chalmers office or distributor for details.

ALLIS-CHALMERS

— Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin, U.S.A. —

POWER AT WORK IN INDUSTRY

New ideas and practices in industrial electrification as presented by industrial, consulting and power sales engineers

Thermostats Tested in Conditioned Air

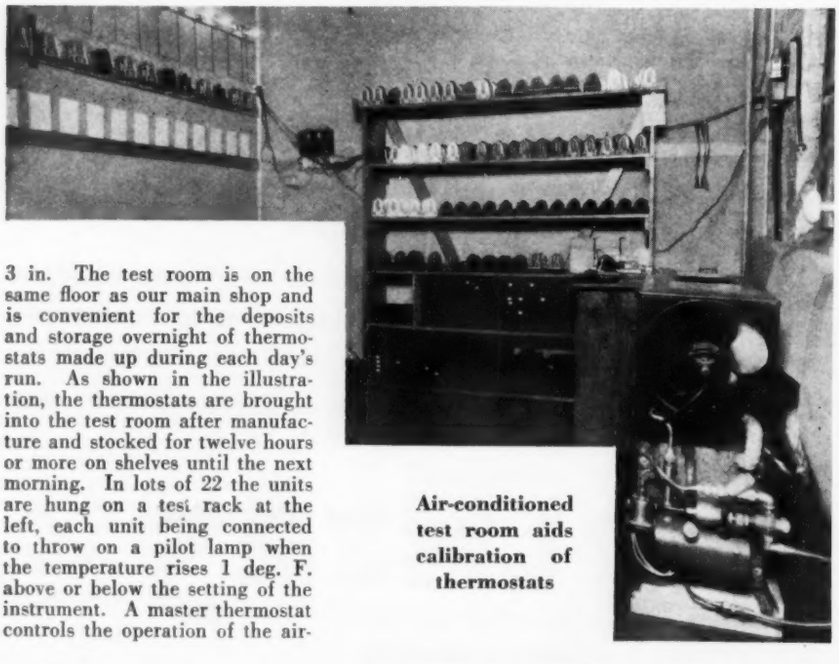
By B. W. DEZOTELL
President United Electric Controls Company, Boston, Mass.

Before we installed a ¾-ton, motor-driven, air-conditioning unit in our testing division it was necessary to try out thermostatic controls manufactured by us for oil burner, stoker and other services under conditions which were unfavorable to accurate and comfortable work in the plant. We have now had two years' experience with air conditioning in test activities and the results have been a reduction of about 50 per cent in the cost of testing thermostatic switches, a satisfactory control of the atmosphere in the test room, freedom from colds suffered by employees when testing under the old conditions where air was fan-blown across ice cakes in our shop basement, and no expense to date for maintenance. The operating cost of the unit has been less than $1 per working day. Electric service is purchased from the local power company.

Tests are made in an insulated room about 14 ft. x 12 ft. x 10 ft. in dimensions, having walls filled with rock wool to a thickness of 3 in. The test room is on the same floor as our main shop and is convenient for the deposits and storage overnight of thermostats made up during each day's run. As shown in the illustration, the thermostats are brought into the test room after manufacture and stocked for twelve hours or more on shelves until the next morning. In lots of 22 the units are hung on a test rack at the left, each unit being connected to throw on a pilot lamp when the temperature rises 1 deg. F. above or below the setting of the instrument. A master thermostat controls the operation of the air-conditioning unit and normally keeps the room at 70 deg. The thermostats are adjusted while in the test position and most of the tests are made on the 70-deg. base.

About 400 units can be stored in the room at a time with present facilities, and the air-conditioning, which also includes dehumidifying, removes the latent heat in the equipment during the night run of the refrigerating outfit. This is a Westinghouse machine equipped with ducts for recirculation of air, dampers also being provided for admission of outdoor air when required.

The unit has a range of from 50 deg. F. at 90 deg. outside temperature to 84 deg. and can be used as desired for maintaining the test room at closely controlled intermediate points, variable according to the type of control apparatus undergoing tests. The air-conditioning unit is driven by a 110-volt, single-phase motor of about ½ hp. and is equipped with a fan motor for air circulation. From an uncertain and unsatisfactory part of our production, testing has been established on an accurate atmospheric control basis which has eliminated former delays and in addition it has become indispensable as a factory adjunct.

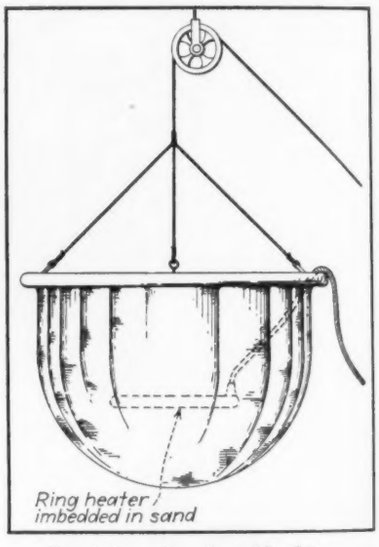


Air-conditioned test room aids calibration of thermostats

Sand Bag Heater for Hat Blocking

By H. R. STEVENSON
The Detroit Edison Company, Detroit, Mich.

Hat cleaning emporia use a singularly ungraceful device suspended by rope and pulley directly over the work table. This is the sand bag. When the chapeau restorer has cleaned your hat and while it is yet in the limp state he molds it on a wooden form substituting for some one's head. Then he lowers the sand bag down onto the hat and packs around it the sand which has previously been heated. The hot sand dries the hat in shape. This is the blocking process.



Sand bag for hat blocking kept hot electrically

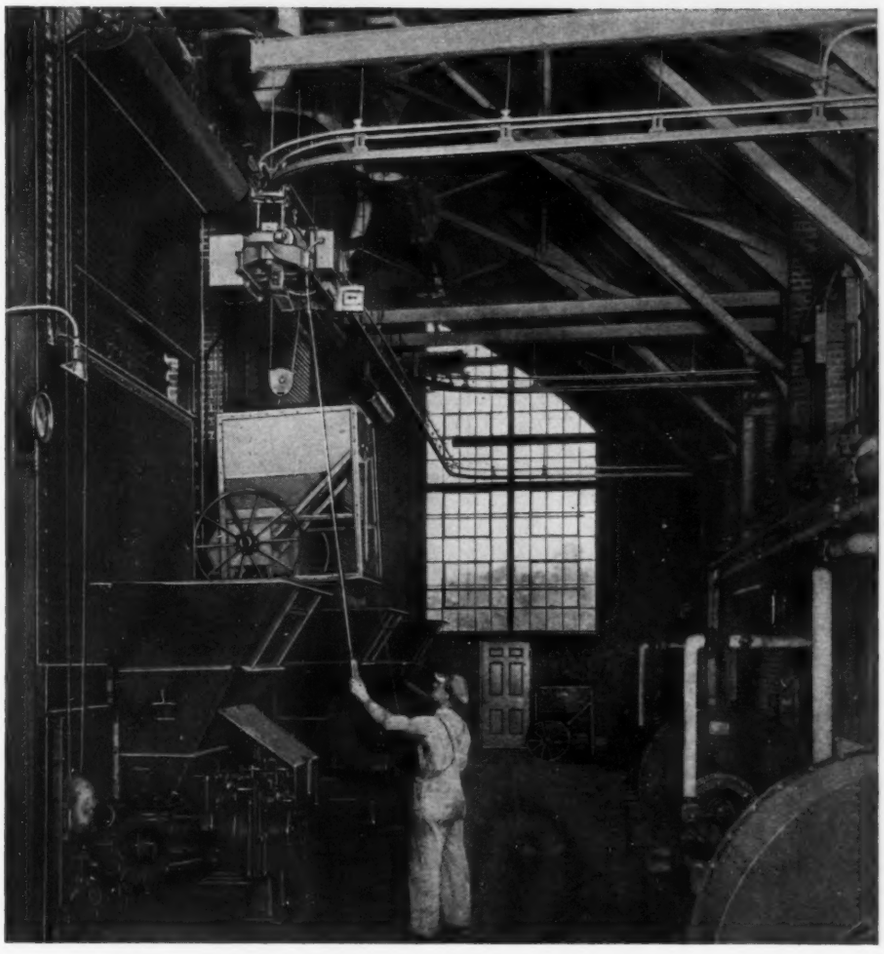
The sand bag in the hat shop is a fine prospect for electric heat; at any rate it has been found so in Detroit Edison territory. The common practice is to heat the sand bag by lowering it onto a heated plate. Sometimes the sand is removed, heated and then poured back into the bag. But whatever way it is done, except electrically, the process is bothersome and inefficient. By the electrical way a 500-watt ring type heater with thermostat control is imbedded in the sand, permanently, and the bag is prepared for

Gently!

—yet—

SWIFT AND ACCURATE

WITHOUT ABUSE TO EQUIPMENT, HE SETS A LOAD OF COAL ON THE EDGE OF THE HOPPER



Monitor push-button control is ideal for material handling equipment such as the Cleveland Tramrail shown above. It makes laborious tasks easy, reduces costs, lowers maintenance and protects motors and equipment. Monitor specializes on automatic reversing control for material handling systems, conveyors, hoist and trolley travel, machine tools, door opening and closing and various other applications. Wherever there is an electrical reversing action, there is a Monitor reversing controller that will meet the exact requirements of the job. Reversing or non-reversing, alternating or direct current; no matter what your electrical control problems may be Monitor can furnish dependable, efficient control apparatus to meet your requirements at costs made possible only by long experience and close specialization in this one field of endeavor.

We invite your inquiries. Monitor sales engineers in principal cities will be glad to consult with you. Write us.

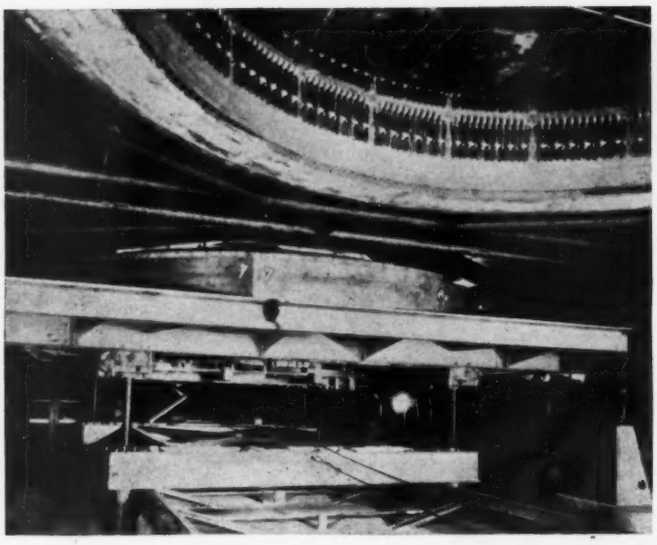
Monitor

AUTOMATIC ELECTRIC MOTOR CONTROL

Ask for catalogue of standard Monitor control equipment. . . . Let us show you how standard parts can be assembled into custom-built controls, at low cost, for complicated applications of all kinds.

MonitorControllerCompany

Gay, Lombard & Frederick Sts.
BALTIMORE, MARYLAND



One degree control by electric heat

Telescope mirror on mold carrier below anneal oven lined with electric heaters

Thermocouples and regulators reduce temperature over a year's annealing of telescope mirror

use just by snapping a switch. Aside from its convenience, the electrically-heated sand bag does much better work, because the sand does not cool off, but remains hot all through the blocking operation.

•

Portable Heater Warms Airplane

Heating a sleeper airplane for winter flights is now accomplished in the hangar of the American Airlines without the necessity of rolling the plane outdoors and running the engines to heat it preparatory to taking on passengers.

A 9-kw. "Electromode" fan-type air heater connected to an outlet in the hangar and placed in the plane has a capacity sufficient to raise the temperature of the passenger compartment from 35 to 73 deg. in ten minutes. As the temperature reaches 72 deg. thermostats on the heater unit cut off half of the heater capacity, slowing the temperature rise. When the temperature reaches 74 to 76 deg., as desired, the remaining 4½ kw. is cut off. After this the heater fan, capable of delivering 650 c.f.m., circulates the air in the plane. Usually performance is limited to use of 9 kw. to heat the plane quickly. An additional 4½ kw. is ample to carry the desired temperature under any weather conditions. Units are made by the Electric Air Heater Company, Mishawaka, Ind.

Portable heater warms sleeper plane before flight

•

Telescope Mirror Annealed Electrically

For a year and a day the 200-in. mirror blank for the world's largest telescope rested in an electric oven at the Corning Glass Works, the temperature gradually subsiding under thermocouple control until the glass could be removed for transportation to California for grinding and subsequent installation at the Mt. Miramar observatory of the Carnegie Institution.

In a recent talk before the Providence Engineering Society, A. E. Marshall, consulting chemical engineer of the Corning company, stated that after the 20-ton disk was poured into a high-temperature refractory brick, electrically-heated mold at about 2,400 deg. F. it was introduced into the oven, where ten base metal thermocouples governed the supply of energy to "Nichrome" heating elements through appropriate reactors and prevented a drop of more than a degree a day in the critical range for maintaining homogeniety in the glass. The operation was a complete success and illustrates the value of electrical methods of heating and control in this important field of scientific research. Two sources of energy supply were available, one being connected to the lines of the local power company and the other to standby facilities within the Corning plant.

"Congratulations, *'Red'* . . .

—on the $2,000,000 Addition!"

Louis F. Riegel, left, General Sales Manager, Virginia Electric and Power Company, congratulates E. S. Fitz, General Manager, Electrical Department, on the announcement of a $2,000,000 high pressure addition to the power station at Richmond, Virginia, made necessary by the steady growth of the company's load.

Likewise, "Red" congratulates Louis on the fine new business additions during 1935, including 10,000 electric refrigerators, 3,500 electric ranges and 2,500 off-peak water heaters, giving a system saturation of 43%, 11% and 3.8% respectively.

Each man sees a busy 1936 in prospect in the attempt to obtain minimum system investment and lower operating costs to permit lower rates for a constantly improved service over a constantly expanding area.

Needless to say, the responsibilities of these men and their associates are great and demand an intimate knowledge of the newest and best practices of the industry. That is why they appreciate the value of ELECTRICAL WORLD and make good use of the service that it provides. If interested in greater details, address ELECTRICAL WORLD, 330 W. 42D ST., NEW YORK, N. Y.

MEN OF THE INDUSTRY

Milwaukee Electric Names Assistant Vice-Presidents

Promotion of three employees of the Milwaukee Electric Railway & Light Company has been announced by G. W. Van Derzee, vice-president and general manager. L. F. Seybold and J. H. Lucas were appointed assistant vice-presidents and Fred A. Luber was named chief architectural engineer. The new assistant vice-presidents will assist officers of the company in administrative matters and in addition will continue their former duties, Mr. Seybold in charge of the company's operating research bureau and Mr. Lucas as active head of the rolling stock department. Mr. Luber becomes head of a newly formed plant engineering department with enlarged staff and responsibilities.

•

Croy, Ferguson and Strom Promoted in Chicago

Three appointments have recently been announced by the Commonwealth Edison Company, Chicago.

Harry C. Croy was named assistant to Vice-President Harry B. Gear, Louis A. Ferguson, Jr., became customers' service manager and Harry L. Strom superintendent of office service.

Mr. Croy started with the company in 1913 as an inspector in the engineering department. He was promoted to planning engineer in 1921 and eight years later became assistant to Harry B. Gear, then assistant to Vice-President Louis A. Ferguson. Mr. Ferguson, Jr., began his Edison career as a surveyor in the constructing engineers department in 1922. Six years later he became construction engineer of the structural division, and in 1934 was appointed assistant general service manager. Mr. Strom rounded out his thirtieth year of service last year.

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▶ GERALD T. SHIPMAN has been elected a vice-president of the Bathurst Power & Paper Company, Bathurst, New Brunswick, Canada.

▶ ROBERT S. EDWARDS recently succeeded his father, the late Robert Edwards, as president of Edwards & Company, Inc. Other changes were announced as follows: Thomas Nolan, vice-president in charge of sales; Christian Miller, vice-president in charge of manufacturing; Edward P. McHugh, treasurer and member of the board of directors; Charles H. Holden, formerly manager of the Chicago office, now assistant sales manager at New York, and John L. Taylor, formerly in the New York metropolitan district, now manager of the midwest district with offices in Chicago. Mr. Edwards is this company's third president and a grandson of its founder.

•

Lamme Medal Awarded to Vannevar Bush

The 1935 Lamme Medal of the American Institute of Electrical Engineers has been awarded to Dr. Vannevar Bush, vice-president of the Massachusetts Institute of Technology, and dean of the school of engineering, "for his development of methods and devices for application of mathematical analysis to problems of electrical engineering." The medal and certificate will be presented to him at the annual summer convention

Vannevar Bush

of the Institute, which is to be held in Pasadena, Calif., next June.

Dr. Bush is noted for his achievements in electrical research and contributions to technical education. He has long been interested in the design of analyzing instruments and is internationally known for his achievements in this field. With the co-operation of Dr. Bush and other members of the Institute staff, several models of the differential analyzer have been built in various parts of the world. He directed the design and construction at M.I.T. of the network analyzer, a device for accurately reproducing and studying the operating characteristics of power networks under the most satisfactory conditions. He has also carried on important studies of transients in machines and inter-connected power systems, and is known for his contributions to the development of thermionic and gaseous conduction tubes. He was active for many years in the introduction of operational methods of circuit analysis to engineering problems, and was one of a group of pioneers in the application of this powerful mathematical method of analyzing transients.

Dr. Bush was invited to join the faculty of M.I.T. in 1919 and his appointment as vice-president and dean of the school of engineering was announced in 1932.

For many years Dr. Bush has been active in the committees of the American Institute of Electrical Engineers of which he is a fellow. He is the author of "Operational Circuit Analysis" and the joint author with Professor W. H. Timbie of "Principles of Electrical Engineering," one of the most widely used books in the field. He has also contributed numerous articles to scientific and engineering publications.

•

Anaconda Takes James "Safety" Smith

News of the appointment of James A. Smith to take charge of all phases of advertising and sales promotion for the Anaconda Wire & Cable Company is an interesting case of recognition for achievement. For "Jimmy" Smith was the man who put over the "Identified Cord" movement in the electrical industry, which culminated in the campaign to "Safeguard Electric Service in the Home" during the recent Fire Prevention Week. Mr. Smith took on the idea in 1933 and by incessant advertising, correspondence, travel and speechmaking has set the problem of cord safety on a firm foundation. Out of this successful campaign "Jimmy" Smith now goes to Anaconda.

Mr. Smith first came into electrical work in the engineering and maintenance department of Kirkman & Sons, soap manufacturers. He has since been with Benjamin Electric Manufacturing Company, Rome Wire Company and American Lithograph Company. From 1929 to 1932 he was sales promotion and research manager of ELECTRICAL WORLD and since then he has been director of the electrical cord manufacturers at the National Electrical Manufacturers Association. During this period the sale of approved cords has increased 300 per cent. Mr. Smith enters on his new work with fine prospects and the best wishes of his many friends throughout the electrical industry.

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▶ L. R. WALLIS, superintendent of the sales department, Boston Edison Company, was the recipient of widespread congratulations, testimonial remembrances and informal felicitations February 19, the thirtieth anniversary of his entering the service of that utility.

▶ THOMAS E. SEARS has been elected president of Firetox System, Inc., Attleboro, Mass., effective February 17. Mr. Sears makes his headquarters at the

BURROUGHS PUBLIC UTILITY BILLING MACHINE

Speeds up and cuts the cost of

CUSTOMER BILLING

NOTE THESE NEW FEATURES

MORE REGISTERS

This new feature permits automatic accumulation of figures by revenue classifications, rate blocks, etc., as a by-product of the billing operation.

LINE PROOF

This new feature detects errors in writing the meter readings and consumption. Meter readers' errors in subtraction, and operators' errors in writing the consumption figures, are detected before the incorrect figure is printed or added. This saves much time in making corrections and in proving bills.

AUTOMATIC COUNT OF BILLS

The machine automatically counts the number of bills added in each register, for proof and statistical purposes.

INCREASED SPEED OF CARRIAGE

Faster carriage operation speeds up the entire billing job.

AUTOMATIC EJECTION AND STACKING OF COMPLETED BILLS

After the bill is written it is automatically ejected and stacked. Thus when the billing work is completed, the bills are in exactly the same order as when they were received by the operator.

This new machine is the fastest that Burroughs has yet developed for handling customers' billing. Whatever plan is used—Stub, Bill and Ledger, or Register Sheet—this new Burroughs will do the job with greater speed, simplicity and ease of operation. It has so many new features of advantage . . . so many of its operations are automatic . . . that the machine may be said to do most of the work without effort on the part of the operator. The famous Burroughs short-cut keyboard further contributes to the machine's remarkable speed and ease of operation.

Investigate. Telephone the local Burroughs office for a demonstration on your own work without obligation to you. Then you can see for yourself to what extent Burroughs Public Utility Billing Machine can speed up and cut the cost of your own billing. Or, if more convenient, mail the coupon for full particulars.

Burroughs

BURROUGHS ADDING MACHINE COMPANY
6932 Second Boulevard, Detroit, Michigan
I would like complete information about Burroughs Public Utility Billing Machine.

Name_____

Address_____

Park Square Building, Boston, Mass., where he is an insurance broker and consultant to the Associated Industries of Massachusetts, having specialized in electrical and other fire hazards for some time.

•

Tips Tool Company Makes New Appointments

Announcement has been made by the Tips Tool Company, Inc., manufacturer of electrical live-line equipment, with headquarters in Taylorville, Ill., of the appointment of new district representatives. Pat Baldwin, Line Construction Material, Tampa, Fla., has been appointed sales representative for Tips Tool Company for the state of Florida. Scott-Jaqua Company, Inc., Indianapolis, has been appointed sales representative for Indiana, and K. H. Best, formerly of Little Rock, Ark., has been made direct factory representative for the promotion of sales of Tips Tool Company.

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▶ CHARLES G. PYLE, assistant sales manager of the Hygrade Sylvania Corporation, has started on his annual trip to the west coast. His destination is California, where he will conduct several meetings of jobbers. En route he will pay visits to many of his corporation's distributors in the Middle West.

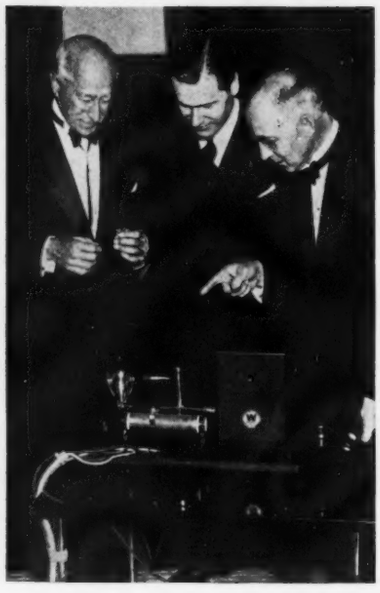
▶ H. D. WEHRLY, manager of the Frigidaire Corporation's marketing and organization department at Dayton, Ohio, has resigned to establish a marketing research organization in New York. Mr. Wehrly has been associated with Frigidaire for nine years in various capacities.

▶ FRANCIS L. BALL, regional executive of the New England Power Association and for many years identified with the gas and electric utilities under the Tenney management at Boston, has been elected president of the New England Gas Association.

▶ EBEN G. CRAWFORD, president of the Cleveland Electric Illuminating Company, has been elected president of the Great Lakes Exposition Corporation, sponsoring organization of the huge exposition to be held on Cleveland's downtown lakefront June 27 to October 4.

▶ A. H. KAHN, formerly Pacific Coast operating manager of the G-E Supply Corporation, San Francisco, was made district manager of the corporation in Chicago, effective January 1, according to an announcement made recently by J. L. Busey, president. Mr. Kahn, who is well known in the electrical field, was for many years connected with the Pacific States Electric Company, San Francisco, prior to its consolidation with G-E Supply Corporation.

Dr. Jewett Explains



Dr. Frank B. Jewett, president New York Museum of Science and Industry (right), explaining to Dr. Marston T. Bogert (left) and Nelson A. Rockefeller, Museum trustees, the manner in which an original 1893 Westinghouse Stopper lamp was turned on by the "sound" of a candle flame on the desk of Michael Faraday in London, England, to set off the dedication ceremonies of the Museum in Rockefeller Center February 11. The light of the Stopper lamp was picked up by the "electric eye" on the table, turning on two banks of high-intensity mercury vapor lamps, the latest development in electrical illuminants, said to mark the beginning of a new era in artificial illumination. Dr. Jewett is head of the Bell Laboratories and Dr. Bogert is professor of chemistry at Columbia University.

OBITUARY

D. N. Barney

Danford N. Barney, president of the D. N. Barney Company, Inc., and vice-president of the Hartford Electric Light Company, died February 23 at his home in Farmington, Conn., in his seventy-eighth year. Mr. Barney joined the Hartford utility in 1892, two years later becoming treasurer. He held that position until 1924, when he became vice-president. Before his association with Hartford Electric he traveled extensively.

In 1905 Mr. Barney was elected to the State Senate and served as chairman of the appropriations committee. He was a director of the Hartford Electric Light Company, the Connecticut Power Company, the Hartford Steam Boiler Inspection & Insurance Company, Colt's Patent Fire Arms Manufacturing Company, the Hartford National Bank & Trust Company and the Hartford Hospital.

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▶ EDWIN H. ROBNETT, who has been associated with the Public Service Corporation of New Jersey since 1921, died January 30 in Newark, N. J., as the result of a cerebral hemorrhage. He was 48 years of age. Mr. Robnett was campaign manager for Public Service, having been in charge of many of the stock-selling campaigns of that corporation.

▶ MORTON HAVENS, president of the Havens Electric Company, Albany, N. Y., wholesale electrical distributors, died February 8 in Albany Hospital, a victim of pneumonia. For many years Mr. Havens was a prominent figure in the capital's business circles. Early in his career he invented the device known as the "condulet." The Crouse-Hinds Company of Syracuse received the exclusive right to manufacture this device. Mr. Havens was in his sixty-second year.

▶ BOYD ANDERSON, for the past twelve years connected with the Allis-Chalmers Manufacturing Company at Los Angeles, Calif., died suddenly January 18 at his home in Alhambra, Calif. He was 43 years of age. Mr. Anderson, who recently had been appointed Los Angeles district manager for the company, after serving for several years as sales engineer, formerly was connected with the Crocker-Wheeler Company in San Francisco.

▶ WILLIAM D. MCELHINNY, a pioneer in the electric refrigeration field and manager of the wholesale division of Frigidaire Corporation, died February 1, following a long illness. Mr. McElhinny was vice-president in charge of sales for Copeland Products, Inc., before going to Dayton in 1933 as manager of Frigidaire's commercial division. Last July he was made manager of a newly organized wholesale division, in charge of quantity sales of refrigeration and air conditioning products to large national users.

▶ MARTIN A. OBERLANDER, wiring supply sales manager Graybar Electric Company until his retirement in 1933, died suddenly, of pneumonia, February 6. Mr. Oberlander became associated with the Western Electric Company in 1890. In 1923, when the supply department of Western Electric was separated from the telephone department, he assumed responsibility for sales of all wiring material with the title of wiring supply sales manager. He held this position during the last ten years of his business career. After his retirement, he still took an active interest in the developments in the wiring field, and kept up the many friendships and associations of his more active years. He was 66 years of age.

METER DEVELOPMENTS PROGRESS

in Modern "A" and "S" Mountings

Sangamo modern meter developments, whether singlephase watthour meters—combination singlephase watthour meters and time-switches, with either single or two-rate registers—or two-element watthour meters—all are designed for modern "A" or "S" mountings.

Many metering requirements are met by this line of modern meters. Standardization of design simplifies installation problems and minimizes cost and space requirements. . . . . .

Top—Types HFA and HFS singlephase watthour meters.

Center—Types HV-11-A and HV-11-S combination watthour meters and time-switches. Can be supplied with single or two-rate registers.

Bottom—Types L-2-A and L-2-S two-element, single disk, watthour meters.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

Heavy Duty
TESTING SETS *for*—UTILITY SERVICE

WHEN many of this country's largest utility companies and electrical manufacturers select one particular make of testing equipment, that apparatus must possess exceptional merit and be especially suited to the requirements.

AMERTRAN has specialized in supplying testing transformers and testing sets to utilities and large industrials for more than 34 years, and these units have come to be accepted as the "Standard of Excellence" for all types of service.

Illustrated is AMERTRAN Testing Set Type TS-10 which has been designed for commercial testing in laboratories of utility companies and cable manufacturers. It is extremely flexible and will furnish a maximum potential of 100,000 volts at 20 Kva.

May we send data on AMERTRAN's complete line of testing sets?

AMER TRAN
TRANSFORMERS
Manufactured Since 1901 by—
AMERICAN TRANSFORMER COMPANY
172 Emmet St. . . . . Newark, N. J.

Power Telemetered on Pennsylvania Line

[*Continued from page 42*]

the combined total of the individual stations on that system. Where the power reversal of any station is to subtract from the combined total load the potentiometer lead is brought from the center of the slide wire and thus movement in the reverse direction will cause a potential to be produced of opposite polarity to the others. The total kilowatt indication for the stations north of Perryville is retransmitted to the Philadelphia Electric Company dispatcher's office in Philadelphia by means of a "retransmitting slide wire" on the mechanism of the total kilowatt recorder.

Load integrated

The kilowatt-hour record is obtained by means of an alternating current, proportional to the total kilowatts flowing in the current element of a watt-hour meter with a constant potential a.c. voltage in phase with the current applied to the voltage element (Fig. 4). Alternating current is obtained by means of a slide wire on the mechanism of a controller. This controller is a "Micromax" self-balancing mechanical relay, the position of which is determined by balancing potentiometrically a d.c. voltage proportional to kilowatt from a slide wire on the total load recorder against a d.c. voltage obtained from a thermal converter the current coil of which is in series with that of the watt-hour meter and the potential coil of which is in parallel with that of the watt-hour meter. Thus, regardless of possible phase differences, the watts in both meters is the same and a true reproduction is obtained in the watt-hour meter of the system power consumption.

Four watt-hour meters with their associated controllers are used. One for the total energy furnished north of Perryville, one for the total energy furnished south of Perryville, one for the energy flowing north through Perryville and one for the energy flowing south through Perryville.

Each of the watt-hour meters is equipped in the usual way with demand contacts actuated by a gear meshing with a worm cut in the watt-hour meter shaft. These contacts in turn transmit impulses to demand printometers and indicating demand meters which give the hourly demand readings.

Load Building in Northwest

[*Continued from page 47*]

In 1931 the company instituted a plan of promoting electric range sales through dealers, and later virtually discontinued the sale of electric ranges by the company. Since that time we have continued to promote aggressively electric cookery through advertising in the newspapers, over the radio, bill stuffers, and by personal calls by the sales organization. The prospects developed through these efforts have been turned over to dealers who have sales people making residential calls.

GLENN L. JACKSON, *California Oregon Power Company and Mountain States Power Company*—Unquestionably, the major causes back of the development of the domestic business in these two companies has been continuous sales effort over a period of the last ten years. Rate adjustments have not been numerous. The adjustments that have been made have created an incentive to utilize electric service for all possible purposes, in that the rates applying to electric cooking service are virtually all purpose and promotional in nature.

J. D. Ross, *City of Seattle*—An intensive drive for sales of appliances, more especially electric ranges and water heaters, has materially aided in building up the residential usage. The result of this effort plus favorable rates and a liberal servicing policy has been to make the electric range so popular here that Seattle has more ranges in service than any other city in the world, regardless of population. This statement will serve as an index of our sales effort to establish a greater domestic demand. Electric water heaters also will be found, from information being supplied, to have increased at a remarkable rate.

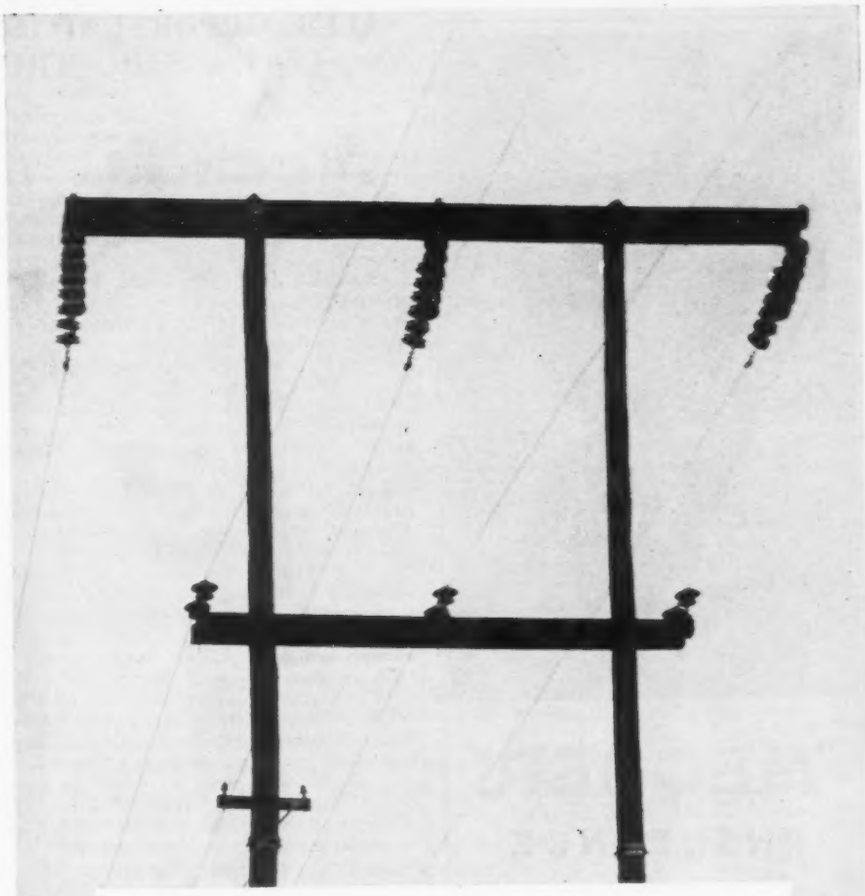
We have at present seven appliance salesmen. These serve on a commission basis rather than a salary.

With regard to our terms of payment, it is possible to write contracts for appliance sales which involve payments covering a period of five or six years. The carrying charge for time payments amounts to one-half of 1 per cent per month. It should be stated, however, that less than 10 per cent of all appliance sales involve a period of payments longer than 24 months.

IRA S. DAVISSON, *City of Tacoma*—We feel that the high annual consumption per customer on the Tacoma system is due to the low rate for residential service which has been in effect for many years. Our sales program is limited to water heaters and ranges and we have limited our sales budget to an amount that would appear ridiculous to some utilities of equal size. The merchandising department usually pays its way.

J. W. MCARTHUR, *City of Eugene*—We believe our increase in domestic business has mostly been due to rate reductions, good service and improved appliances. Economic conditions have a strong bearing on the use of electricity as shown by the loss of range customers during the depression. The kilowatt-hours increased during that time, however, probably due to increase in refrigeration and to the lowered rate. Thirty-five per cent of the customers within the city of Eugene use electric ranges. If it had not been for the free range wiring. and the advertising which was confined almost entirely to refrigerators and ranges, there might have been a decrease in consumption.

Previous to 1929 the Water Board left all the promotion of appliances to dealers. Since 1929 the Water Board has furnished free range wiring, much of the advertising, and now takes over the dealers' contracts for purchases of ranges and water heaters on installments.



TO build soundly, with an eye to future maintenance costs, implies reliance upon the demonstrated value and economy of AmCreCo poles. Made from select southern yellow pine and treated with a preservative of known value timed to proper seasoning, AmCreCo poles offer inherent strength and the quality to resist deterioration over a long period of years.

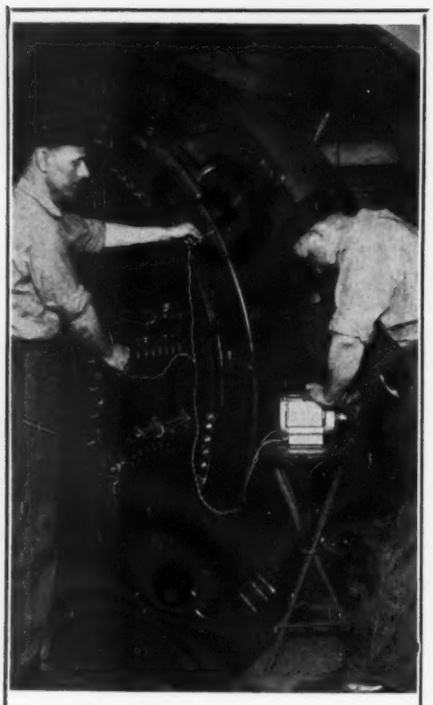
AMERICAN CREOSOTING COMPANY
INCORPORATED

COLONIAL CREOSOTING COMPANY INCORPORATED

AMCRECO LOWRY PROCESS PATENTED

GEORGIA CREOSOTING COMPANY INCORPORATED

LOUISVILLE — KENTUCKY



"MEGGER"

TRADE MARK REGISTERED U.S. PAT. OFF.

INSURANCE

"I am an owner of a Megger instrument bought from you about 6 or 7 years ago, and if I couldn't buy another one, I wouldn't sell it for a thousand dollars. Being the Electrical Engineer for——— Stores, I have a great deal of insulation testing to do as it is vital to the operation of our electrical equipment, which runs up high into the thousands of dollars and I depend solely upon the Megger for accurate tests . . . and I know at all times just how the equipment stands and where the weak spots are."

From an unsolicited letter from an Electrical Engineer in Chicago

It is good Insurance to make "Megger" tests

Write for descriptive "Megger" Catalog 1400-W.

JAMES G. BIDDLE CO.

ELECTRICAL INSTRUMENTS

1211-13 ARCH STREET PHILADELPHIA, PA.

Other Biddle Specialties:

- "Megger" Insulation Testing Instruments
- "Megger" Ground Testers
- "Megger" Capacity Meter
- "Ducter" Low Resistance Testing Sets
- "Dionic" Water Tester
- "Frahm" Vibrating-Reed Tachometers and Frequency Meters
- "Jagabi" Rheostats
- "Jagabi" Speed-Measuring Instruments

SALES OPPORTUNITIES IN NEW CONSTRUCTION

WILMINGTON, N. C.—Tidewater Power Company, Wilmington, plans new transmission and distributing lines for rural electrification in eastern part of state, totaling over 100 miles, with power substation and service facilities. Cost about $142,000. Financing in such amount has been arranged through Federal aid.

INDIANA HARBOR, IND.—Youngstown Sheet & Tube Company, Youngstown, Ohio, plans installation of motor-generator sets, heavy-duty motors and controls, transformers and accessories, regulators, conveyors, electric traveling cranes and hoists, and other equipment in new tin plate mill at Indiana Harbor, to be equipped for complete automatic and electric-controlled operation. Cost close to $2,000,000.

NEW CUMBERLAND, W. VA.—Monongahela-West Penn Public Service Company, Fairmont, W. Va., plans extensions in transmission and distributing lines in part of Hancock County for rural electrification, including facilities for service at Pughtown, Congo, Middle Run and other points.

KNOXVILLE, TENN.—Director of Purchases, Tennessee Valley Authority, Knoxville, receives bids until March 13 for 298 steel transmission towers, single-circuit type.

URBANA, OHIO — Champaign County Rural Electrification Corporation, Urbana, has plans for transmission and distributing lines in different parts of county for rural electrification, totaling about 415 miles, with service facilities. Fund of $595,000 has been secured through Federal aid and work will begin early in spring. Power supply will be secured from city-owned power plant at Piqua, Ohio.

SANTA MONICA, CALIF.—Douglas Aircraft Company plans installation of motors and controls, conveyors, electric hoists, etc., in new plant addition, 300x300 feet. Cost over $250,000. Edward C. and Ellis W. Taylor, 803 West Third Street, Los Angeles, are architects.

ROCHESTER, MINN.—Will take bids in April for new 7,500-kw. turbo-generator unit (with alternate bids on 10,000-kw. unit), with complete auxiliary equipment for city-owned electric power plant. Other improvements will be made at station. Entire project will cost about $200,000.

WINFIELD, W. VA. — Kanawha Valley Power Company, Charlestown, W. Va., has secured Federal permission to construct and operate a hydroelectric generating plant at new Federal dam to be constructed on Kanawha River, near Winfield, and will proceed with project in near future. Initial installation will total 26,000 hp., divided into four 6,500-hp. hydraulic turbine units. Project will include construction of steel tower transmission lines to tie in station with recently completed hydroelectric power plant of company at Federal dam at Marmet, W., Va., on same river, about 36 miles distant. Cost about $3,000,000.

ST. LOUIS, MO.—National Dairy Products Corporation, 120 Broadway, New York, N. Y., plans installation of motors and controls, conveyors, electric hoists and other equipment in new milk products plant to occupy an entire block of property at St. Louis. Cost about $1,000,000.

PORTLAND, ORE.—United States Engineer Office, Second District, Portland, receives bids until March 13 for 2,400-volt metal-clad switchgear for power station service at Bonneville, Ore., Project (Circular 264).

CHATTANOOGA, TENN.—Has authorized immediate surveys and plans for new city-owned transmission and distribution system, with power substations and switching station. Power will be secured from TVA, with large power substation at city limits. Project has been in temporary abeyance for several months and work is now scheduled to start in spring. Bond issue of $8,000,000 has been voted.

NEW YORK, N. Y. — Department of Water, Gas and Electricity, Municipal Building, Maurice P. Davidson, commissioner, plans expenditure of about $1,000,000 during 1936 for new street-lighting equipment and facilities, including extensions and replacements.

WELLINGTON, OHIO — Lorain-Medina Rural Electric Co-Operative, Inc., Wellington, plans transmission and distributing lines for rural electrification in parts of Lorain and Medina Counties, including service facilities. Fund of $232,700 will be secured through Federal aid. Work will begin early in spring. Power service will be secured from city-owned plant at Oberlin, Ohio.

CEDAR RAPIDS, IOWA—Iowa Electric Company, Cedar Rapids, plans new transmission lines in parts of Cedar, Guthrie and Jones Counties, with distributing lines for rural service. Application has been made for permission.

WASHINGTON, D. C.—Bureau of Supplies and Accounts, Navy Department, Washington, closes bids March 6 for one motor-generator set for local yard (Schedule 7256).

MOBILE, ALA.—Ruberoid Company, 500 Fifth Avenue, New York, plans installation of motors and controls, conveyors, regulators, etc., in new addition to roofing products plant at Mobile. Cost about $200,000.

NEVADA, MO.—State Building Commission, Capitol Building, Jefferson City, Mo., receives bids until March 11 for extensions and improvements in power plant at institution at Nevada, including installation of new equipment. Cost about $190,000. Black & Veatch, 4706 Broadway, Kansas City, Mo., are consulting engineers; Charles A. Haskins, Finance Building, Kansas City, is supervising engineer.

RENSSELAER, IND. — Plans early call for bids for new underground transmission and distributing system in number of streets, with street-lighting installation of cast-iron standards. Project will include three transformer stations and 2,300-volt primaries. Charles Brossman, Chamber of Commerce Building, Indianapolis, Ind., is consulting engineer.

CHARLOTTE, N. C.—Southern Chemical Corporation, Charlotte, care of John L. Crist, 1042 Arbsley Road, Charlotte, president, recently organized, plans installation of motors and controls, conveyors and other equipment in new local chemical products manufacturing plant. Cost about $100,000.

SHERBROOKE, QUE. — Is considering construction of new city-owned electric power plant. Cost over $400,000, with transmission and distributing lines, and power substation facilities.

MASON CITY, IOWA—People's Gas & Electric Company, Mason City, plans extensions in transmission lines in Cerro Gordo County, with distributing lines and service facilities for rural electrification. Application has been made for permission.

SEATTLE, WASH.—Fred J. Rogers, Textile Tower Building, architect, plans installation of motors and controls, conveyors, etc., in new food products canning plant on waterfront, for company whose name is temporarily withheld. Electrical installation will be under direction of George N. Barker & Associates, Textile Tower Building, electrical engineers. Bids will be asked soon. Cost about $130,000.

YORKTOWN, TEX.—Soon takes bids for new city-owned electric power plant, including distributing lines and power substation facilities. Appropriation of $100,000 has been secured through Federal aid.

New Device Speeds Rate Analysis

[*Continued from page 50*]

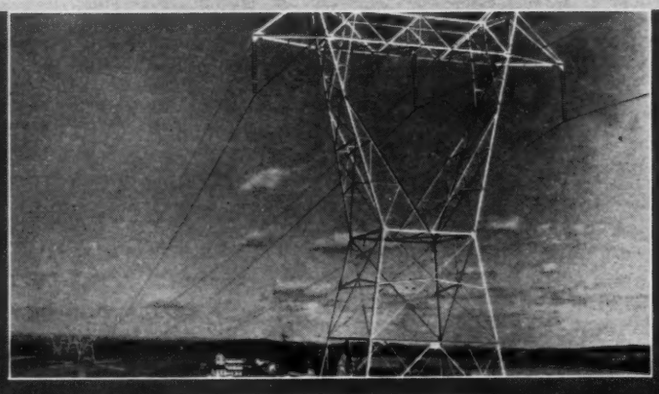
From our observation, this new machine will tabulate from 2,000 to 4,000 bills per hour. Thus, by combining speed with simplicity of operation, expense is reduced to a point materially below that of previous methods and it appears that on an analysis similar to that required for this particular study the cost of the completed analysis would be from 25 to 50 per cent less than if produced by any of the other methods. The accompanying table compares briefly the features of the three systems.

In this comparison so far all three methods have been considered in relation to one single objective, an analysis of a full year's consumption for rate reduction studies. This new machine, however, due to its lower cost of bill analysis work, opens up another field which has heretofore been little used, because of the time and expense involved—that of making a current monthly bill analysis. If the original bill analysis is made on a monthly basis and an analysis of each current month obtained there is available a continuous up-to-date bill analysis. Such an up-to-date analysis, by months, is useful in checking the activities of the new-business department by providing comparative tests of results of different types of advertising or load-building campaigns, and in determining whether increased consumption is being sold to the smaller, less profitable customers. Undoubtedly, it will prove of value for various other purposes.

Summary

Our recent experience with this latest available method indicates so material an improvement over all previously used means as to be worthy of general consideration. Necessarily, this new device cannot be accepted as superseding all other methods for all requirements. The hand method still will be useful if the work can be done with permanent clerks and without interfering with regular routine, or where the number of bills to be analyzed is not large, or for power rate analysis. The punch card method will still be useful, particularly where such cards are a product of the normal billing procedure, or the bill analysis data are to be used for more than the rate studies.

BLAW-KNOX PRODUCTS
for
PUBLIC UTILITIES

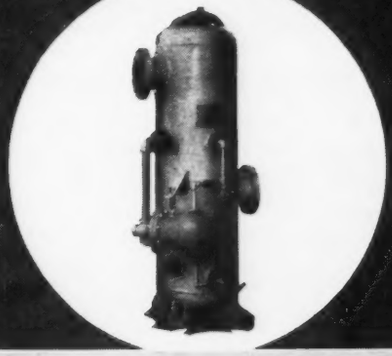


TRANSMISSION TOWERS

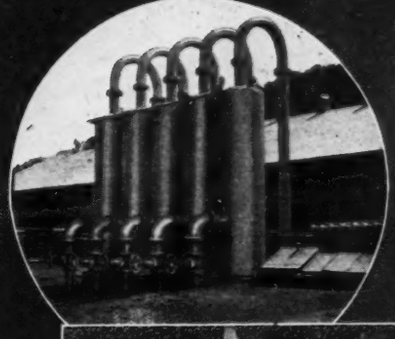
Thousands of miles of transmission towers . . . structural work necessitating highly specialized fabrication . . . enormous areas of Electroforged open flooring . . . standard steel buildings for all uses . . . gas cleaners for natural gas lines . . . steel forms for concrete tunnels, walls, etc. . . . steam purifiers, desuperheaters . . . clamshell buckets . . . and other products of Blaw-Knox manufacture are at work for the Public Utilities of America.

The fact that Blaw-Knox Products are in accord with the rigid standards of Public Utility purchasing is proof not only of the merit of the products themselves but of the house behind the products.

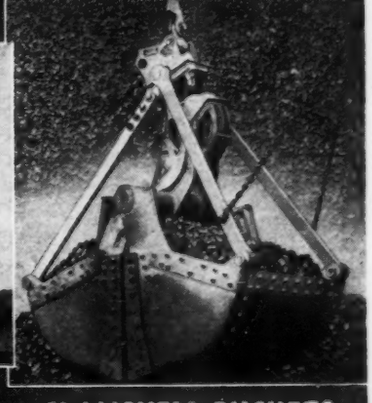
DESUPERHEATERS



GAS CLEANERS



STEEL BUILDINGS



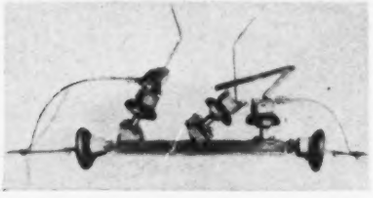
CLAMSHELL BUCKETS

BLAW-KNOX COMPANY
2013 FARMERS BANK BUILDING, PITTSBURGH, PA.

NEW EQUIPMENT AVAILABLE

Sectionalizing Switch

Intended for use on rural distribution lines, this horn-gap, tilting insulator type sectionalizing switch features ease of mounting, multi-point floating high-pressure contacts and easy operation. Universal joints on the "grasshopper" permit angular line wire connection without putting strain on connections. Sleet hood protection for contacts is provided.



Type RT; rated capacities 200 amp., 7,500 to 34,500 volts, and 400 amp., 7,500 to 15,000 volts. **Schweitzer & Conrad,** Chicago, Ill.

•

Variable-Speed Drive

Any standard make of constant-speed motor can be used with this variable-speed control unit to meet requirements for an adjustable speed power source. Infinite speed variation between predetermined limits is attainable by adjusting a hand wheel. This simultaneously varies the diameter of two pulleys mounted on parallel shafts and connected by a V-belt. One shaft receives power from the motor and the other transmits it to the driven machine. Reduction units of the helical gear type may be incorporated in the unit to provide speed variation from 1.35 to 3,480 r.p.m.

"Vari-Speed Motodrive;" available in horizontal and vertical design, four sizes in each design, ½ to 7½ hp. covering speed ratios from 2:1 to 6:1. **Reeves Pulley Co.,** Columbus, Ind.

•

Furnace Control Unit

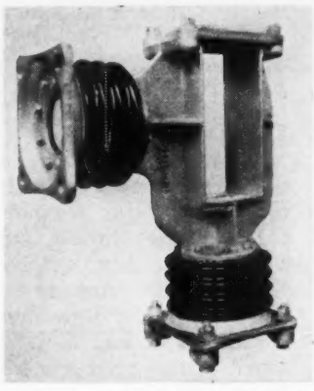
Both units operated on 110 volts a.c.: pull developed 75 lb. **Automatic Temperature Control Co.,** Philadelphia, Pa.

Two motor-driven multi-position controllers, known as "Relatrol" and Balancer," provide control of furnace temperature with minimum disturbance to furnace atmosphere. Both units produce a corrective movement in a valve or damper in exact relation to departure from the temperature setting measured by the actuating instrument. A special relay is wired in both instruments between the actuating instrument and the motor mechanism. This relay embodies an electrically controlled null-point which assists in returning the relay to its static no-contact position. Thus desired sensitivity is independent of mechanical balance. The result is a "dead-beat" motion. Balancer is similar to the Relatrol except that it is provided with automatic load compensation and is intended for use where load changes will be of considerable extent and duration.

•

Mill-Type Bus Support

Designed to carry eight 8 x ¼-in. copper bars for extraordinarily heavy bus runs. Two insulators are provided at right angles to each other. The lower insulator mounts on steel I-beams, while the side-supporting insulator mounts on a concrete wall. Rollers and spring spacers permit free lateral movement of the bus.

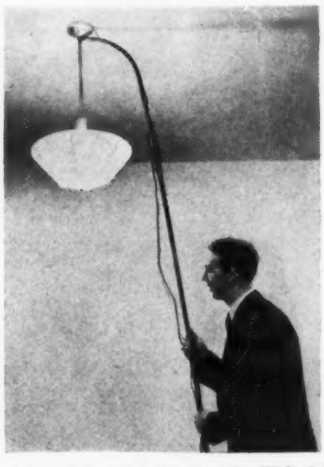


Rating 7,500 volts. **Delta-Star Electric Co.,** Chicago, Ill.

•

Lighting Demonstration Kit

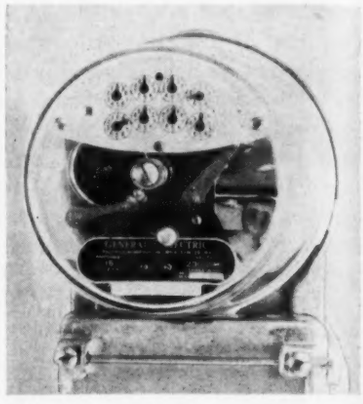
Lighting salesmen may use this angling device to demonstrate lighting fixtures. Unit consists of a jointed metal pole by which the fixture can be held in its proper position against the ceiling while the light intensity is being measured. This device, together with a new lighting fixture of this make (shown), is introduced in the form of a kit for salesmen.



Weight of kit 14 lb. **F. W. Wakefield Brass Co.,** Vermillion, Ohio.

Meter and Time Switch

Metering and control of domestic loads, including off-peak water heating, are combined in this watt-hour meter and time switch. The new meter is available in three forms—single dial register with contacts, used where metering and control of water heating load must be separate from rest of the load; double dial register with contacts for installations where off-peak water heater control is desired but where the entire load is lumped during off-peak periods; double dial register without contacts, where there is no off-peak control of water heating but where the entire load is placed on a different rate during off-peak periods. Positive mechanical gear shift is provided at the register worm which operates simultaneously with contact opening and closing.

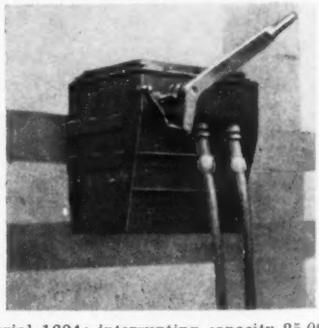


Designated as IR-20-A or IR-20-S, depending on whether I-20-A or S type meter is desired with the T-28 single-dial contacts register; T-29 (shown) double dial with contacts register or the T-30 double dial without contacts register. **General Electric Co.,** Schenectady, N. Y.

•

Oil Circuit Breaker

This single-pole subway breaker is available for use on voltages of 2,500/4,000 Y. It is equipped with expulsion chamber contacts and an adjustable a.c. series tripping mechanism which gives either instantaneous or time-delay action. The breaker is completely inclosed in an oil- and water-tight tank.



Serial 1604; interrupting capacity 25,000 kva. at 2,500 volts. **Pacific Electric Mfg. Co.,** San Francisco, Cal.

•

General Utility Welder

High electrical efficiency is a feature of this welder. Bare or coated electrodes from 3/32 to 3/16 in. may be used. Single-current control is accomplished by shifting brush-holders for current settings over the entire welding range. For field service the welder can be mounted on a two-wheel trailer. Two types of drive are available; electric motor equipped models are driven

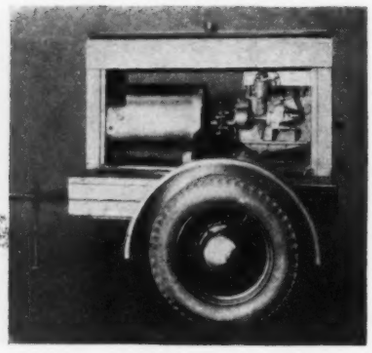
UNIFORMITY

—is what makes team work whether in mass-training or in mass-production. It is the final test of conscientious effort, physical skill and knowledge of the game. • There need be only one weak sister to defeat a good team. There need be only one defective insulator to ruin a good line. • That is why you too should "Specify Porcelain Products."

Why not ask us for specific facts and figures which will show why *you* should "Specify Porcelain Products" suspension insulators. « «

Specify PORCELAIN PRODUCTS Made by PORCELAIN PRODUCTS, INC. PP

PORCELAIN PRODUCTS INC. PARKERSBURG, W. VA. • U. S. A.



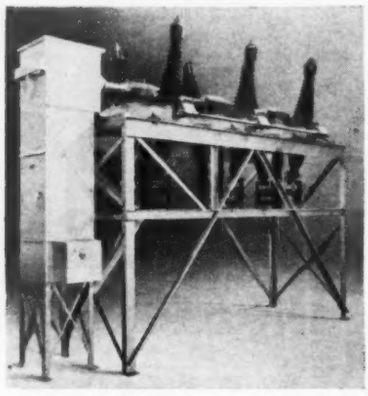
P&H Hansen Model W-150: 150 amp. capacity. **Harnischfeger Corporation**, Milwaukee, Wis.

through a V-belt, gasoline-engine-driven units are direct connected and run at 2,200 r.p.m.

•

Reclosing Mechanism

Demands for fast reclosing oil circuit breakers lead to development of this motor-wound, spring-actuated reclosing mechanism. Re-establishment of the circuit within ½ sec-



Type MK-3 (shown set up on 69-kv. breaker). **Pacific Electric Mfg. Co.**, San Francisco, Cal.

ond after the breaker trip coil is energized is claimed. Subsequent reclosures occur at adjustable time intervals. Motor drive requires 20 amp. at 125 volts d.c. Mechanism can also be operated from a.c. source.

•

Portable Oscillograph

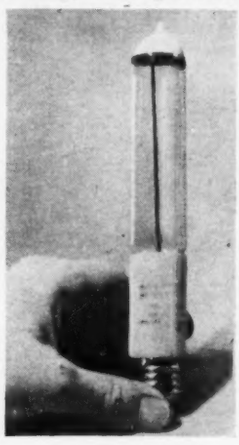
Simplicity and low cost are features of this portable cathode-ray oscillograph, which is designed for field and laboratory investigations. It is an all-purpose instrument

Model CRA. **Clough-Brengle Co.**, Chicago, Ill.

with built-in tuning sweep and high sensitivity amplifiers. Newly simplified controls permit easy operation.

Mercury-Vapor Lamp

A 250-watt high-intensity mercury-vapor lamp is now available to supplement the 400-watt size already on the market. An efficiency of about 30 lumens per watt is claimed for the new lamp, which produces 7,500 lumens for an average life of 2,000 hours. Operation with a current-regulating transformer is necessary and use in inclosed globes is suggested to protect the lamp from cooling effects of circulating air, since a single clear glass bulb (T-9) is used in this lamp as contrasted with the double glass bulb of the 400-watt design.



Medium screw base; over-all length 8 in. Burns in any position. **Westinghouse Electric & Mfg. Co.**, E. Pittsburgh, Pa.

•

Rural Line Anchors

"Thimbleye" anchor, helix diameter 4 to 10 in., length of rod 54 to 96 in.; "Ozark" anchor, blade dimension ¼ x 2½ in., rod diameter ½ in. **A. B. Chance Co.**, Centralia, Mo.

Two new anchors are now available to meet requirements of light rural lines. The "thimbleye" screw anchor has its helix wedged on an anchor rod the eye of which is large enough to permit the rod to be used as a wrench. The "ozark" is a two-way expanding anchor which is expanded by turning the anchor rod after the anchor has been dropped into the hole. Expanded area of the anchor is 16 sq.in.

•

Metal-Clad Switchgear

Extension to light-weight service permits application of this type metal-clad switchgear to central stations, industrial plants, office buildings and the like. Each unit has stationary and removable element. It includes oil-blast circuit breaker, instrument

Type FK-42 breaker employed in either of two ratings, 600 amp. and 5,000 volts or 800 amp. and 2,500 volts; interrupting capacity 25,000 kva., either manually or electrically operated. **General Electric Co.**, Schenectady, N. Y.

transformers, disconnecting devices, supporting structure and interlocking elements. The circuit breaker (FK-42) forms the removable element.

ENGINEERING DATA FROM MANUFACTURERS

Bulletins and catalogs now available to engineers by manufacturers and associations

Five pamphlets covering the engineering features, applications, dimensions, rating, etc., of its available equipment are to be obtained from Worthington Pump & Machinery Corporation, Harrison, N. J. They include:

	Pages
W-321-B7—Open impeller centrifugal pumps	4
W-312-B1A—Single-stage volute centrifugal pumps	4
W-102-B1—Horizontal duplex piston pumps	Folder
L-611-B4A—Single-horizontal, single-stage compressors, 5, 7 and 9-in. stroke	7
L-611-B5A—Single-horizontal, single-stage compressors, 11 and 13-in. stroke	7

"Modern Melting" is a new 41-page co-operative handbook-catalog issued for the foundry industry by the Detroit Electric Furnace Company, 825 W. Elizabeth St., Detroit, Mich. It contains general melting information, a catalog of rocking arc-furnaces and a section devoted to information on auxiliary furnace equipment. A section of interest to power companies is also featured.

Data sheets covering floodlighting of softball fields (PM. 21E:03B), football fields (BM21-B01) as well as plant forcing with electric light (BM, 10:1) are available from Benjamin Electric & Manufacturing Company, Des Plaines, Ill.

Construction and Test of Enclosed Switches, Specification No. 4, Part II, of the Canadian Electrical Code covering essential requirements and minimum standards of electrical equipment is now available from Canadian Engineering Standards Association, Ottawa, Canada.

"Repair of Damaged Cast Iron Machinery" is an 8-page illustrated booklet of Linde Air Products Company, 205 E. 42d St., New York, which consolidates known facts regarding the repair of damaged cast-iron machinery by oxyacetylene process.

Electrical wires, cables and cords are the subject of a 67-page book available from the Crescent Insulated Wire & Cable Company, Trenton, N. J. In this book are latest specifications for principal types of wires and cables, together with engineering data in an easily usable form.

A discussion of accidental deaths traceable to electricity is included in "The Mortality From External Causes," a study by the Metropolitan Life Insurance Company, New York City. Statistics covering the period 1911-1930 are given.

Fundamentals of window display methods are discussed in a display manual which the Westinghouse Lamp Company, 30 Rockefeller Plaza, New York City, has prepared for its 1936 display service. Manual divided into five sections: (1) Principles of Design. (2) Color and Its Use. (3) Display Appeals. (4) Display Pictures. (5) Lighting. Each section discusses fundamentals which should be followed in every type of window display.

Construction, uses, variations, features and economies are the "Five Important Points on Servit," discussed and illustrated in the six-page bulletin of that name now available from Burndy Engineering Company, Inc., 305 East 45th Street, New York City. Data on sizes, weights and dimensions of different connectors are included.

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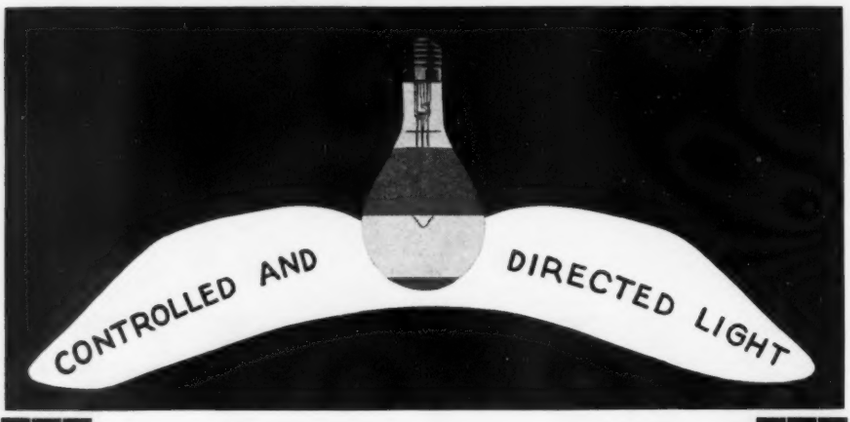

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Selling Power to Industry

[*Continued from page 52*]

an interest in it, to be nothing more than another and reasonably sound step in the larger program which has enabled the industry to develop to the extent that it has.

It is a simple enough matter to accomplish the sale of electricity, if the price is right and the use is obvious, but the industry cannot wait for obvious uses if it can hope to build itself into the position it should occupy in the country's industrial life. Its tendency has been too much to live and to serve alone and apart from all other industries; not understood—misunderstood; not always understanding—sometimes misunderstanding those it serves.

If doing the job properly is going to call for expenditures not now in the budget of the average power company, they must be made and they must be justified as an essential operating cost. Success in justifying these expenditures is going to depend largely upon the belief that the organization has in that particular department of its service and in its being—as it should become—an indispensable adjunct to the mere generation and delivery of electricity.

It is incumbent upon the power industry to develop a new relationship, a new community of interest, which it can only secure by deliberately going after that which it has not had; that is, a more intimate knowledge of the needs of those whom it serves, of what they can afford to pay for those needs and of how it can supply them. Only as the result of the development of that sort of strong buyer-seller relationship, which should materially serve to rip away misunderstandings that exist between itself and those whom it serves, can the power industry hope to assume its proper place in the national industrial picture and defeat those efforts that would transfer its service to a governmental bureaucracy, grinding out standardized service from standardized plants.

That expression of opinion—that claim—may seem a silly exaggeration, but it is sound selling methods, selling a sound product, that have made every successful industry in this country today. The power industry supplies a sound product. It would seem nothing more than logical that it should apply a maximum of ingenuity and ability to its sale.

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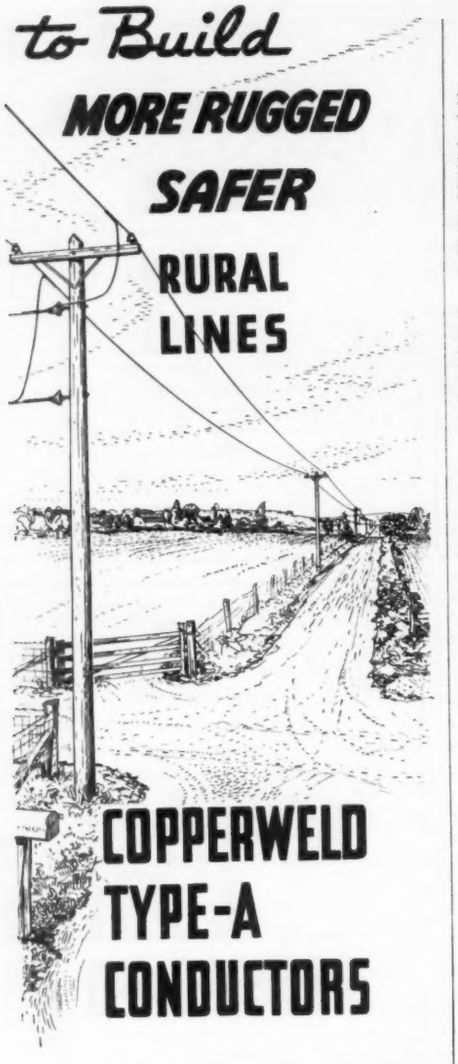

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Municipal Plants

EL DORADO, ARK.—Fight to obtain funds for construction of a municipal light plant will be continued, city council having passed a resolution authorizing the mayor to apply for a P.W.A. loan of $575,000. The city had previously asked for a higher amount. The city recently entered into a new contract with the Arkansas Power & Light Company after considerable discussion between the city council and the utility company.

FRANKLIN, GA.—City has closed a deal with the Georgia Power Company whereby it has sold its municipal light plant to the power company. The plant was purchased outright, but the city will continue to operate it until the Georgia Power Company can run its transmission lines into Franklin.

JACKSONVILLE, ILL.—William N. Hairgrove, Jacksonville attorney, has filed a complaint to test the legality of the proposed municipal light and power plant, which was approved by a vote of local citizens last month, with himself as complainant. He asks that the city be enjoined from erecting, constructing or acquiring an electric generating and distributing system as proposed in the ordinance. The suit is the second filed since the election on January 21. On the day following the election, attorneys for the Illinois Power & Light Corporation introduced a suit in the federal court at Springfield seeking an injunction against the project (ELECTRICAL WORLD, February 1, page 86).

MARQUETTE, KAN.—City officials have undertaken a tour of Kansas towns served by municipal electric plants, preparatory to formulation of data which is expected to reveal "the possibilities in connection with municipal ownership of electricity in Marquette."

EUREKA, KAN.—Voters defeated by three to one the granting of a ten-year franchise to the Kanas Electric Power Company.

ST. MICHAELS, MD.—Application has been made to the state Public Service Commission by the Utilities Commissioners of the city to acquire an electrical transmission and distribution line operated in the Miles River Neck section of Talbot County. The system is operated under franchises granted in 1931 to the late William Herman Hopkins. The commissioners operate a system in St. Michaels and vicinity, and seek to acquire the other system at a price of $1,500. No loan will be necessary. The commissioners told the state commission in their petition. A public hearing on the application will be held on March 6.

KENYON, MINN.—On February 12 voters turned down by a vote of 313 to 214 a move initiated by petitioners to oust the municipal light, power and water commission and return its functions to the village council. The special election was called after petitioners charged the commission was responsible for rate discriminations and was planning to enter a contract to sell electric energy to other municipalities at cost. The petition stated the city's $100,000 municipal light plant was not equipped to produce sufficient energy for sale to outside points.

BOONVILLE, N. Y.—City has filed with the state Public Service Commission a revision of electric rates which reduces the extension charges on rural lines to $2.00 per customer after five years from the time when the extension is energized. The revision is effective in the territory served by the village plant outside the Village of Boonville which includes the towns of Boonville, Ava, Lewis, Lee, Leyden and Western. At the suggestion of the commission the village has also revised the minimum charges of residential and commercial rates to conform to the extension charge revision. The change is estimated to save consumers $900 a year with maximum and minimum individual reductions of $4.60 and 90 cents per month.

YORKTOWN, TEX.—An election will be called soon to vote on the proposal to issue $55,000 of bonds for the construction of a municipal electric light and power plant, Mayor William Westhoff has announced. The W.P.A. has approved the city's application for a grant of $45,000 for the project. The city is now being served by the Central Power & Light Company.

FREDERICKSBURG, VA.—Feeling that it is not getting enough revenue from its municipal gas plant, City Council will appoint a committee shortly to look into the advisability of establishing a municipal electric plant to operate in connection with the gas plant. Councilmen pointed out that the contract with the Virginia Electric & Power Company does not terminate until 1939.

DAYTON, WASH.—City plans to employ a hydraulic engineer to make a survey as to the feasibility of erecting a municipal power plant.

BETHLEHEM, PA.—Northampton Common Pleas Court has refused to reconsider its action in permanently enjoining the construction of a municipal electric power plant and summarily rejected every one of the city's objections to the reasons for its order. The Court concurred in the contention of the Pennsylvania Power & Light Company that the city had already exceeded its borrowing capacity and could incur no further indebtedness through Federal grants or otherwise. The city received a grant of $115,000 from the P.W.A. last April in order to complete the half-finished plant.

NEW HYDE PARK, Long Island, N. Y.—Long Island Lighting Company filed action last week and obtained a temporary injunction in the District of Columbia Supreme Court against a P.W.A. grant of $135,000 for construction of a municipal electric plant and distributing system. The temporary restraining order was issued by Justice Oscar Luhring and is effective until the end of February.

•

Electrical Display at San Diego Fair

A complete change in the electrical exhibit idea for the 1936 edition of the San Diego exposition has been planned under the sponsorship of the Bureau of Radio and Electrical Appliances of San Diego County. Last year the exposition, while employing electricity for unusual lighting and spectacular effects, was considered disappointing in its electrical display. Taking the initiative, San Diego Consolidated Gas & Electric Company and the Bureau of Radio and Appliances are enlisting the aid of manufacturers and distributors for a worth-while exhibit.

The former transportation building, with a gross area of about 19,000 sq.ft., is being rearranged for the new Palace of Electricity. The entire cost has been underwritten by the sponsors with the co-operation of the exposition management. Participation will be by invitation.

Recent Rate Changes

NEW YORK STATE ELECTRIC & GAS CORPORATION has filed with the state Public Service Commission a revision of electric rates effective in the town of Reading and part of the town of Dix in Schuyler County. The changes reduce the unit charges in the second and third blocks of the annual residential rate for ordinary use and add a new rate for residential use when the customer has in regular use an electric range or an electric water heater. The changes will give residential users in this area the same rates now charged in the adjacent territory of the New York Central Electric Corporation which is an affiliated company. The new residential rate is $1.00 for the first 10 kw.-hr. or less, 8 cents per kilowatt-hour for the next 17 kw.-hr., 5½ cents per kilowatt-hour for the next 23 kw.-hr., 4 cents per kilowatt-hour for the next 50 kw.-hr., 3 cents per kilowatt-hour for the next 100 kw.-hr. and 2 cents per kilowatt-hour for all use over 200 kw.-hr. The new rate for residence use when the customer has an electric water heater or range in regular use is $1.00 for the first 10 kw.-hr. or less, 7 cents per kilowatt-hour for the next 25 kw.-hr., 4 cents per kilowatt-hour for the next 65 kw.-hr., and 2 cents per kilowatt-hour for excess use.

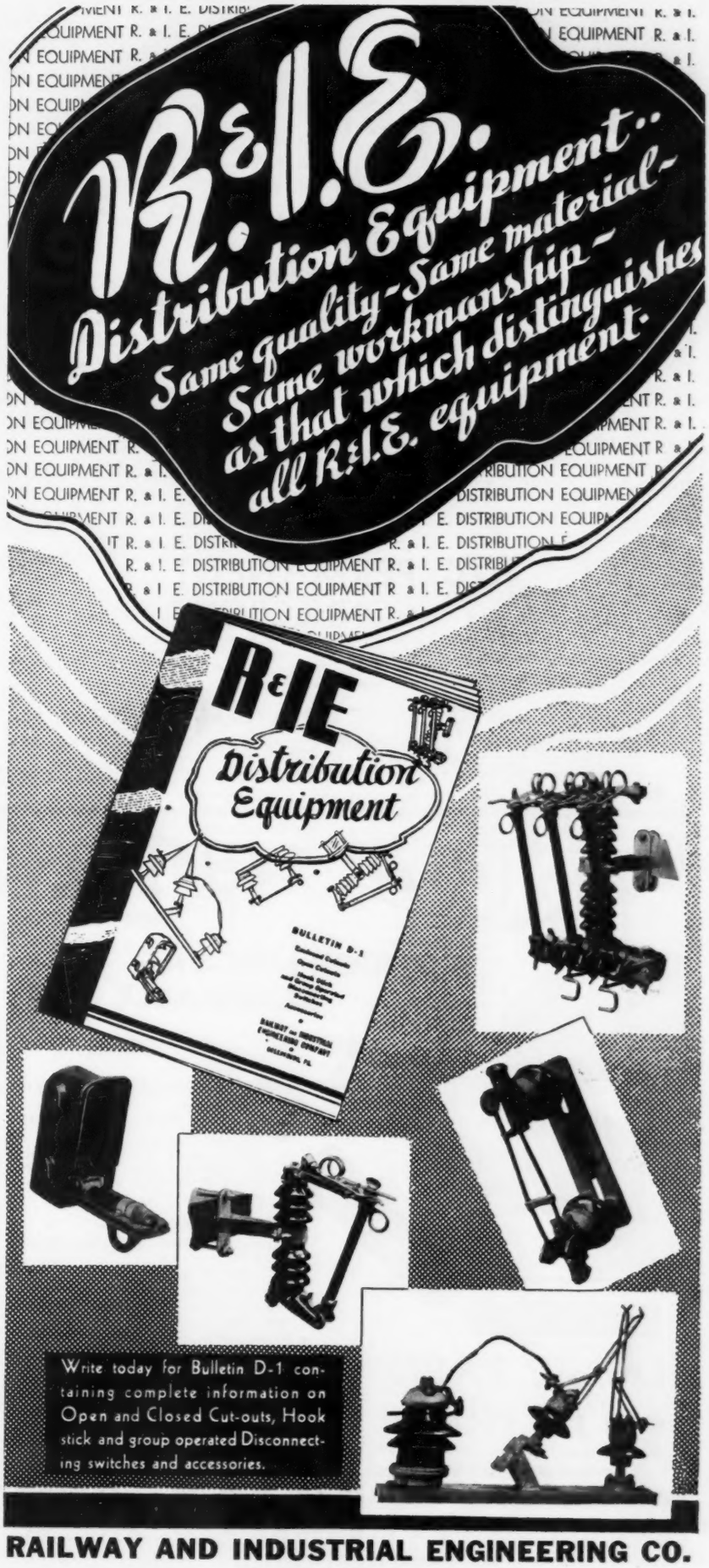
NEW YORK POWER & LIGHT CORPORATION has filed with the state Public Service Commission a revision of electric rates for its Mountain District which is estimated to save consumers in parts of Warren, Washington, Saratoga and Essex Counties about $18,800 annually. Changes in the residential rates are estimated to save those customers $7,588 annually. The changes in commercial and industrial rates is estimated to save consumers $11,233 annually.

DUKE POWER COMPANY has announced rate reductions effective March 1, estimated to save its customers in North and South Carolina $529,000 a year. In its announcement the company stated the reduction had been approved by rate regulatory bodies of both states. Of the total, $479,000 is represented by cuts in electric charges, and $50,000 by lowered gas charges. Electric savings will be divided as follows: residential, $203,000; commercial lighting, $173,000, and retail power, $103,000. The residential rate will begin at 80 cents for the first 10 kw.-hr. and will range down to 2½ cents per kilowatt-hour for all over 100. For commercial users the base rate will be the same, but will range downward to 1.9 cents for all over 2,000 kw.-hr. For retail electric power service, the schedule calls for 4 cents per kilowatt-hour for the first 50, and ranges downward to 1.2 for all over 350,000 kw.-hr. used.

•

Harvester Increases Its Power Contract

Inaugurating an extensive program of change-over from steam to electric drive in existing mills and of building new mills, the International Harvester Company has renewed its power contract with the Commonwealth Edison Company for service to Wisconsin Steel, in Chicago. The present load at the steel plant is 11,000 kw. The renewed contract, which runs for ten years, provides for the addition of 5,000 kw. in May of this year and covers additional successive large blocks of power which are expected to bring the total load to 52,000 kw. in 1940.



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BOOK REVIEWS

Federal Power Commission Public Utility Maps

Service Areas of Principal Systems (Map 1). Generating Plants and Transmission Lines (Map 2).

Published by the Federal Power Commission, Washington, D. C. Price, mounted on linen: Map No. 1, $10; Map No. 2, $7.50. Unmounted: No. 1, $7.50; No. 2, $5.

These two maps are based on data submitted to the Federal Power Commission. They are unquestionably the most accurate, comprehensive and authoritative publications of their kind now available, and being of large size, approximately 5 by 7 feet, show details that could not otherwise be brought out.

Map No. 1, in 16 colors, shows the service areas of companies controlled by the principal holding companies and other important utility systems, constituting in all about 90 per cent of the industry in terms of generating capacity and volume of business. These various groups, but not the individual subsidiary operating companies, are indexed in the legend.

Map No. 2, likewise covering about 90 per cent of the industry, shows the location of 345 hydro-electric plants (total capacity 8,187,914 kw.), 709 fuel-burning plants (capacity 22,350,114 kw.) and 135,000 circuit miles of transmission lines, including all lines of 60 kv. and above, and 63,000 circuit miles of lower voltage, all identified by key numbers as to operating companies. Transmission-line voltages are indicated.

There has long been need of maps of both of these types. The Federal Power Commission has done two excellent pieces of work in meeting this need.

•

Manual on Preservative Treatment of Wood by Pressure

By J. D. MacLean. U. S. Department of Agriculture, Washington, D. C. 123 pages, illustrated. Price, 15 cents.

In spite of the phenomenal growth of timber preservative treatment, the literature is scant and scattered. This Forest Products Laboratory publication glossaries the processes, the mechanism of preservation, its variables, technique and results with plenteous data and specifications throughout. It provides an authentic handbook summary.

•

Automatic Protection of A.C. Circuits

By G. W. Stubbings. Published by the Instruments Publishing Company, 1117 Wolfendale Street, Pittsburgh, Pa. 300 pages, illustrated. Price, $5.

Certain of the protective schemes used for these systems originated in Europe. Practice there today is not at wide variance with protective practice here and consequently this book by a British author has distinctive value to American system designers and operators. In recording and analyzing this technique for the higher voltage apparatus and circuits he starts

by giving an unusually fitting discussion of the current and voltage transformers and their interconnection schemes and limitations.

Before proceeding to the sources and propagation of fault currents there is a chapter on symmetrical components which covers and delves deeply enough to establish the subject as a working tool for fault analysis. Relay discussion is confined to schematic presentations of the principles and functions, not omitting the recent distance relays, with or without supplementary time-lags or bias. Although pilot wire methods are discussed, nothing appears to be included about carrier-current relaying. Nor is there any treatment of consequence in connection with low-voltage networks. An appendix presents a valuable glossary of terms. On the whole the book gives a well-rounded picture of circuit protection without resort to oscillograms, numerical examples of fault calculation or portrayal of commercial designs of protective equipment.

•

Administrative Proficiency In Business

By Erwin Haskell Schell. Published by McGraw-Hill Book Company, 330 West 42d Street, New York City. 291 pages, no illustrations. Price, $2.50.

Executive turnover is the target of this book by the professor of business management at M.I.T. He advocates long tenure and decries the shortcomings of the "five-year" incumbents. Thirty-three chapters with such titles as "circumstance," "difficulty," "verification," "exception" take the incoming executive through from appointment to a full acclimation to an enduring officiation. The mirror is held constantly before the administrator to reflect his mental processes and the adaptation of his attitude and self-discipline to the confronting situation. As a consequence those industries which are highly technical and draw their executives dominantly from the technical and engineering channels will find this book peculiarly effective in that it ignores the mechanics of administration for the sake of elaborating on the human being as a psychological entity endowed with an intellect that knows few charts but does recognize the "situations" that make worth-while jobs. The utility industry could cultivate this approach to advantage.

•

Communication Networks (Vol. II)

By Ernst A. Guillemin. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York City. 587 pages, charts. Price, $5.

This embracive Massachusetts Institute of Technology text, despite its title, is of direct interest to power engineers because all the fundamental and rigorous mathematics of lines and networks of any length, characteristics or applied frequency are included. Problems and specific applications are naturally in the communication field, but the steady state, transient, standing wave and parameter analyses are thoroughly generalized. Especial space is devoted to network, lattice and filter and their functional performance. Power engineers will appreciate the lucid treatment of the synthesis point of view in network design because its adoption from the communication field is already in progress in the area of problems with power magnitudes.

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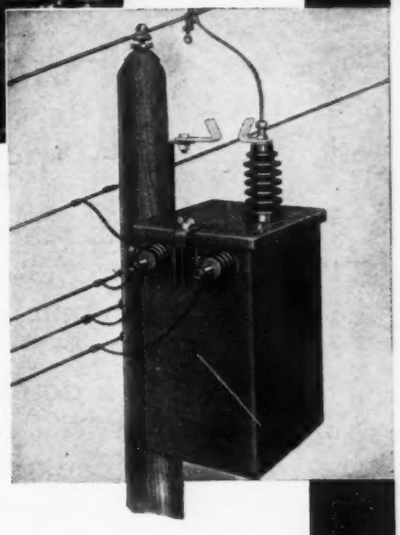

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